

UNIVERSITY OF ILLINOIS

Agricultural Experiment Station

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CIRCULAR No. 218

THE SELF-FEEDER IN PORK PRODUCTION

By W. J. CARMICHAEL

The use of self-feeders in swine production has been greatly extended in recent years. Experimental data and experience indicate that self-feeders have a use in one form or another on all farms from which any considerable number of hogs are marketed. To secure the best results, intelligent choice of feeds to be fed from them, as well as the exercise of good judgment in selecting the time and place of use, is essential.

Most types of self-feeders will give a continuous supply of shelled corn, but there are only a few types which will operate successfully with tankage, oil meal, middlings, or ground grain.

THE SELF-FEEDER IN PORK PRODUCTION

By W. J. CARMICHAEL, Associate in Animal Husbandry

The self-feeder is utilized primarily to save labor by permitting the hogs to help themselves to the feed as frequently as they choose, rather than giving them their ration in one or more feeds daily. It is also of much value in increasing the rate of gains and consequently shortening the feeding period for market hogs.

The feeder may be made for any number of feeds and may be of any desired size. However, care must be taken in the construction of the opening thru which the feed passes from the hopper into the trough. The size of this opening should be adjustable, in order to regulate the flow of feeds of different kinds for different bunches of hogs and for various weather conditions. An opening which can be either entirely closed or opened about three inches is adapted to most feeds. If the adjustment is not properly made, either so little feed passes into the trough that the pigs cannot satisfy their appetites or there is so much that a great deal is thrown out and wasted by them. Unless the feeder is properly constructed, more time will be consumed in its care than would be required for hand-feeding the same swine.

The prospective user of the self-feeder should carefully consider the purpose of his hog production. If the animals are to be developed for breeding purposes, they should be well grown rather than fattened, lest they become so fat that their future usefulness is impaired. On the other hand, market hogs should be so fed that they are in high condition when weighing about 225 pounds and are then ready for the market. The self-feeder furnishes the feeds in such quantities that maximum condition is acquired in a minimum of time. It is, therefore, primarily suitable for fattening hogs and with caution may be used in feeding breeding stock.

Many beginners have failed in starting pigs on the self-feeder. Too often they do not consider the detrimental effect of a sudden change from light to full feed or of changes in the feeds used when an unlimited quantity is being fed. The best method seems to be either to get the pigs on almost a full feed before the self-feeders are used or to put into the feeders an increasing amount of feed each day until there is some left at night, and then fill them. Care should be taken to see that the different compartments contain at all times their respective feeds (unless the supplementary feeds are hand-fed), and furthermore, that they are available in the troughs; otherwise the pigs will fill up on the obtainable ingredients of the ration. Such a "no-choice" system may not be economical. In any event, a sudden change from light to full feed should be guarded against when beginning the use of the self-feeder.

THE SELF-FEEDER IN PORK PRODUCTION

FEEDS

Any feeds ordinarily used for hogs can be fed from a self-feeder. Shelled corn, oats, middlings, oil meal, tankage, and other dry feeds are commonly used. Ear corn can be self-fed, altho it is not well suited for such a method of handling. A few hog raisers have fed buttermilk or skim milk from especially constructed feeders resembling automatic waterers, or "hog fountains," and others have used legume hay in racks built for that particular purpose. Two or more feeds should be used at one time, altho it is not necessary to have all of them self-fed. In fact, many successful stockmen prefer to use corn in the feeder and hand-feed the supplements; others keep a high-protein feed, such as tankage, in the feeder at all times and regulate the amount of carbonaceous feed, such as corn, by hand-feeding. In



FIG. 1.—THE ILLINOIS SELF-FEEDER

The feed passes from the two compartments of the hopper into the trough under the hinged doors. These doors can be pushed into the hopper by the pigs, thus preventing the caking of feed. This type is the most satisfactory yet found by this station.

almost any self-feeding system in the corn belt, corn should be the main grain used in the feeder. If corn is to be turned into pork with profit, some supplementary feed must accompany it. For this purpose tankage, dairy by-products, middlings, or oil meal may be used.

BALANCING THE RATION

The pig will balance his own ration if given an opportunity, and he will probably do it better than most people do it for him. This station has found that various bunches of pigs will eat different proportions of the same feeds, which is an indication that they have different tastes, or desires. On account of the difference in appetite, it is impossible to predict in advance just what ration should be given for the best gains.

In addition to the variation in food requirements for different bunches of pigs, results at this station indicate that the same pigs will eat varying amounts of the same ingredients as they become older and heavier. In tests recently conducted at this station in which pigs were fed corn and tankage in the feeders, the daily consumption per head by periods, beginning when the average individual weight was 47 pounds, was as follows:

	Shelled corn pounds	Tankage pounds
1st period (four weeks).....	2.1	.40
2d " " ".....	2.7	.47
3d " " ".....	3.8	.54
4th " " ".....	5.6	.44
5th " " ".....	7.2	.36
6th " (24 days).....	7.3	.26

At the end of the test the pigs weighed 259 pounds each, as an average, and had made daily gains of 1.30 pounds per head.

In a second lot, in which middlings were fed with corn and tankage, the pigs ate practically the same amounts of corn and tankage as those in the first lot, and in addition, more than twice as much middlings as tankage. In the second lot, however, the gains were more rapid, being at the rate of 1.40 pounds per day, giving a final weight of 277 pounds. It seems, therefore, that the addition of middlings increased the rate of gains.

ECONOMY OF GAINS

The economy of gains depends, of course, upon the relative cost of the feeds. Many people are of the opinion that with the self-feeder the gains will be made on less feed than with other methods of feeding. Results obtained at this station will not warrant such a conclusion. In fact, in the various tests in which the hogs have been carried on to the same weight, the amount of feed required for a given amount of gain was slightly less for the hand-fed hogs than for those

which were self-fed. Some tests at other stations indicate a slight saving of feed due to the use of the self-feeder.

SELF-FEEDERS AND PASTURE

Self-feeders for grain and supplementary feeds may be used satisfactorily with pigs on pasture. Where the pigs are allowed all the feeds they will consume, they will eat a smaller amount of forage than where a limited ration is fed; consequently, more pigs can be pastured per acre. These full-fed pigs will be nearly, if not quite, ready for market when the forage is gone, but they will have consumed a larger amount of grain or feed other than forage than those given a limited ration. Light rations in connection with pasture save little, if any, grain as compared with self-feeding, but they do save supplementary feeds; however, the gains are slow and it is necessary to finish the hogs after the forage is gone. When pigs on forage are fed lightly, the gains made will appear cheaper than those made by pigs on a full feed, but it must be borne in mind that the light-fed pigs are not ready for market when the forage is gone, but must

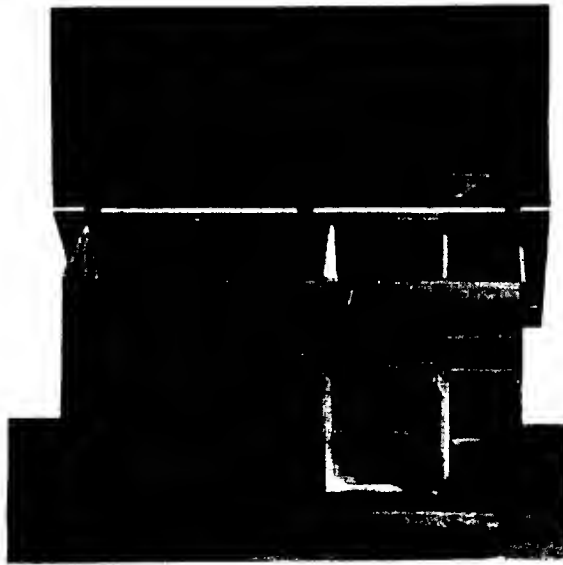


FIG. 2.—SELF-FEEDER USED IN EXPERIMENTS AT THE ILLINOIS EXPERIMENT STATION

This is a common type of self-feeder, with compartments, adjustable sides, and an inverted trough deflector in the hopper.

be subsequently fattened. They will ultimately require slightly more feed per pound of gain than the pigs that are self-fed. In case there is a shortage of grain, or if the feed is high in price during the summer, it is nevertheless an economical system to grow pigs slowly on pasture with a small amount of grain and then finish them on self-feeders with corn and tankage or other suitable feeds as they become more available. If pigs on forage are self-fed, corn alone is insufficient to furnish a balanced ration. Some feed of high-protein content, such as tankage, buttermilk, or linseed oil meal, is needed to supplement the corn and forage under such conditions.

Where "hogging-down" corn is practiced (which is really self-feeding), the supplementary feeds should be self-fed in order to insure the most rapid and economical use of the corn. Likewise, with pigs following steers the self-feeding of supplementary feeds is conducive to more rapid gains and increased economy of production.

MISCELLANEOUS USES OF SELF-FEEDERS

Pigs will begin to eat corn or other feeds when four to six weeks old, and for supplying fresh feeds for them, there is probably no other device which is as satisfactory as the self-feeder. It furnishes a continuous supply of clean, palatable feed. Middlings, oats, corn, or other desirable feeds can be used. For young pigs it is best to supply a growing ration rather than one that is too fattening, as corn alone would be.

Brood sows may be self-fed for limited periods, but in the continuance of the practice care should be exercised to avoid getting them too fat for their future usefulness. If bulky feeds are used, they may be self-fed with safety. Alfalfa, bran, or oats can thus be given alone in the feeder, or may be used to dilute the corn and tankage ration or other feeds which are being fed. Sows will not normally over-eat of a bulky ration even tho they may be self-fed.

Even when swine are not to be pushed for market, the self-feeder may be used as a receptacle for their feeds. The allowance of feed for the day may be put in the hopper of the feeder daily and the hogs permitted to eat as they choose until the feed is gone. This provides the feed in a clean, sanitary form and eliminates the necessity of mixing the dry feeds and feeding in the form of slop or swill.

Even tho the self-feeder may not be used for grain, there is a definite use for it with every bunch of swine. Hogs of all ages need more minerals than they are fed or can find under most conditions, and to supply this need, a suitable mixture should be kept before them continually. A self-feeder is the best sort of container, and its use will give excellent results if some mixture such as slack coal, charcoal, or wood ashes, 3 parts, ground limestone or air-slaked lime, 2 parts, and salt, 1 part, is kept in it at all times.

Water can also be self-fed and should be available constantly for all hogs under all conditions.

TYPE AND FINISH WITH THE SELF-FEEDER

There is no doubt but that healthy pigs given a suitable variety of good feeds in the self-feeder will get ready for market about as rapidly as is possible under any system of finishing. To be sure, some shotes which are predisposed to early fattening will be "done" sooner than the others if the feeds are available for their maximum development. Ordinarily, hogs of a squatty, easily fattened type are ready for market first and may even be ready to go when weighing 150 pounds, if self-fed from weaning time. If they are active and good on their feet, it is probable that they can be successfully continued on the feeders and sold with the remainder of the bunch; but if they are poor-footed or inclined to be sluggish and inactive, it is best to let them go as soon as they are finished, regardless of their weight. Occasionally shotes become so fat, when weighing 125 pounds or more, that they develop the thumps, as do very fat suckling pigs. When individuals are found in that condition, they should either be slaughtered or be fed a lighter ration and given an abundance of exercise until they recover. However, very little trouble is experienced if the shotes attain a weight of 90 to 120 pounds before being given access to the self-feeder. Pigs of a stretchy or rangy type, even tho self-fed from the time they are weaned, very seldom fatten to an undesirable degree before they have attained a good market weight.



FIG. 3.—A CHEAP BUT SATISFACTORY TYPE OF SELF-FEEDER FOR MINERALS

TEN DON'TS FOR THE USE OF THE SELF-FEEDER

1. Don't feed corn in the feeder without some good supplement. Pigs need additional protein and minerals.
2. Don't forget the water and minerals—self-feed them both.
3. Don't start the pigs on the feeder without working them up to a full feed gradually.
4. Don't let the feed sour in the bottom of the hopper.
5. Don't use the feeder unless you want the pigs to get ready for market at the rate of about 1.25 pounds gain per day.
6. Don't feed breeding animals from the self-feeder unless they are very thin or unless a sufficiently bulky feed is used.
7. Don't expect to self-feed pigs to as great a weight as you can carry them when hand-feeding; they finish at a lighter weight.
8. Don't confine the self-fed pigs to such a small lot that they do not get the proper amount of exercise.
9. Don't set the feeder in a mud-hole. Put it on a platform at least, and under a roof if possible.
10. Don't trust the feeder to do it all. You must fill it when empty and inspect it daily to see that it is working properly.

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Agricultural Experiment Station

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CIRCULAR No. 221

OUTLINE OF A PLAN FOR CORN BREEDING

By LOUIE HENBIE SMITH¹

Various systems of corn breeding have been proposed, each possessing its advantages and disadvantages. The possibilities for variation in procedure at many points are so numerous as to make it seem useless to attempt to lay down explicit directions to be followed absolutely in all details. There are, however, certain fundamental principles that must be recognized in this work. With these facts in view, the following outline is offered as a general guide, it being understood that many details are left to the judgment of the breeder to be carried out as conditions and circumstances may determine.

In the plan here described there are proposed two alternative methods of procedure to be followed after the first year's work; namely, *mass selection* and *pedigree selection*, which are described here as Method A and Method B, respectively. *Mass selection* is much the simpler and it is recommended for the busy farmer who may not be able to give the time and attention required by the more exacting methods of pedigree selection. Pedigree selection offers the greater possibilities for improvement if properly carried out, but success depends absolutely upon the accuracy with which all details of the work are

¹Chief in Plant Breeding.

conducted, and this system is recommended only for the breeder who can give the requisite time and the careful attention demanded.

The proposed plan of breeding is laid out under the following sections:

- I. THE FOUNDATION STOCK
- II. THE PRELIMINARY EAR-ROW TEST
- III. SUBSEQUENT BREEDING—TWO ALTERNATIVE METHODS
 - A. Breeding by Mass Selection
 - B. Breeding by Pedigree Selection

I. THE FOUNDATION STOCK

1. Choose a variety well adapted to the local environment, at the same time taking into consideration commercial demands.
2. Select a large number of desirable ears, the more the better—several hundred if possible. It is preferable to take them from the standing plants in the field, selection being made in accordance with suggestions given in Section III, Method A.
3. Number each ear, skipping the even 10's to provide for checks, as explained below. Descriptive records of size, shape, type, etc., are of interest but not absolutely essential.
4. Germinate a sample from each ear. Observe variations in relative vigor. Such a test affords an excellent means of getting acquainted with your foundation stock.

II. THE PRELIMINARY EAR-ROW TEST

1. Select a uniform piece of land for an ear-row performance test. Plow so that the corn rows may be planted across the furrows at right angles. The same applies to the spreading of any manure or fertilizer on this land.
 2. Plant seed from each ear in an individual row, numbering the rows to correspond with the ear numbers. A good, permanent label showing the row number should be placed at every tenth row.
 3. Reserve the remnants of the ears for possible future use. Protect these remnants from the weather and from mice and other vermin.
 4. Plant check rows from a uniform lot of seed at intervals of every tenth row, starting with No. 0 and continuing with the rows 10, 20, 30, and so on.
 5. Duplicating the series adds immensely to the reliability of the work, and running a triplicate series is still better.
 6. Rows should be 20 to 40 hills long, according to whether they are repeated.
 7. The preferable system of planting for this purpose is one stalk to the hill, in which case the hills may be about 20 inches apart within the row.
 8. No detasseling is necessary in this plot.
 9. Watch the rows thru the growing season and compare their development. Notice characteristic tendencies of each individual row as a whole and note especially any variation in maturity.
 10. Harvest and weigh each row separately. Taking into consideration state of maturity, select seed from the highest yielding rows. It is suggested that for Method A about 10 percent of the rows be taken; for Method B, not less than 40 rows.
- (Repeating this trial a second year with the same ears will add still more reliability to the final selection.)

III. SUBSEQUENT BREEDING—TWO ALTERNATIVE METHODS

From this point, the breeding may follow either one of two different systems, namely *mass selection* or *pedigree selection*, as outlined in the following divisions under Method A and Method B, respectively.

METHOD A—BREEDING BY MASS SELECTION

1. Mix together the remnants of the most productive ears as determined by the preliminary ear-row test.
2. Plant this composite seed in a patch which is so located that the plants will not be exposed to crossing, thru contact with pollen of other corn. This plot we may call the seed patch.
3. Early in the autumn go into this seed patch and select ears from the standing corn, paying particular attention to the following points:
 - a. Select only from hills having two or more plants and with no missing hills adjoining.
 - b. Avoid plants growing in close proximity to barren plants.
 - c. Select strong, vigorous stalks that are neither broken, leaning, weak, nor diseased.
 - d. Ear should be borne not too high on the stalk and preferably hanging downward at maturity.
 - e. Avoid excessively long or short shanks.
 - f. Place special emphasis on maturity by making the selection early enough to distinguish between early and late tendencies as indicated by color of husks and denting of grain.
 - g. In this manner proceed each year to select seed from the field. After the first year, the special seed patch may or may not be maintained, but the hand-picking should be practiced regularly.

METHOD B—BREEDING BY PEDIGREE SELECTION

1. Select a plot of uniform land as well isolated as possible from other kinds of corn (40 rods or more distant). Exercise precaution regarding plowing and fertilizing as mentioned above in Section II, paragraph 1.
2. Plant the remnants of the most productive ears as determined by the preliminary ear-row test, each ear in an individual row. In order to guard against possible detrimental effects of inbreeding, it is suggested that at least 40 such rows be planted.
3. Number the ears and the rows to correspond, allowing for a check row every 10th row.
4. Plant check rows of a uniform lot of seed, at regular intervals—every 10th row. These check rows must be detasseled completely.
5. A duplicate planting in another field will add immensely to the reliability of the work.
6. Make the rows 200 hills or more long.
7. Provide for an even stand by planting extra kernels and thinning the plants after they come up.
8. Detassel one-half of each breeding row, alternating the detasseled ends (or, if the duplicate planting suggested above is made, detassel entirely the alternate rows in each plot, taking the even numbered rows in one plot and the odd numbered rows in the other).
9. Detassel every plant in all check rows.

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10. Detassel all inferior plants everywhere in the plot.
11. Harvest and weigh each row separately.
12. According to the performance record, select a proportion (not greater than one-fourth) of the competing rows.
13. From these high-yielding rows, select an equal number of ears from detasseled plants, the total number of ears selected being sufficient to furnish seed ears for a similar breeding plot the following year.
14. Keep records sufficiently complete to show at least the pedigree and the performance of every seed ear used in the breeding plots. To these may be added other records of significance when breeding for special characteristics.
15. Proceed in similar manner in subsequent years.
16. Plant a multiplying plot from extra seed produced in the selected rows of the breeding plot.
17. Select each year from the multiplying plot the best seed for planting the commercial fields.

UNIVERSITY OF ILLINOIS
Agricultural Experiment Station

CIRCULAR No. 230

THE ROUND BARN

(Revision of Bulletin No. 143)

By WILBER J. FRASER



URBANA, ILLINOIS, SEPTEMBER, 1918

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THE ROUND BARN¹

BY WILBER J. FRASER, CHIEF IN DAIRY FARMING

The demand for better farm buildings is growing. The increasing cost of building calls for economical construction. Heretofore permanency and convenience in farm buildings have not received the consideration which their economic value warrants. A sacrifice of either of these qualities means, in the end, loss of time and money. This is especially true on the dairy farm, where so much time is spent in barn work and chores and where large quantities of feed are handled and stored. With this in mind, the round barn was planned as requiring the minimum number of steps in performing the daily tasks, in combination with the maximum convenience.

Round barns rightly constructed are of such recent origin that the principles and methods involved are somewhat new to many builders, varying as they do in many respects from those governing rectangular construction. Since the publication of Bulletin No. 143, "Economy of the Round Dairy Barn," in February, 1910, the interest in this type of barn has steadily increased. Round barns have been built which, while satisfactory, have not been planned to the best advantage or have mechanical defects in construction that detract from their economy or convenience, or both. These defects could easily have been eliminated had the builders possessed a better knowledge of the principles involved.

Experience has shown that no one type of barn will answer every purpose to the best advantage. An analysis of the requirements usually calls for a combination of many different features to meet most adequately the needs of a particular case. Barns should combine utility, economy, strength, and sanitation. They may do this and still display good architectural design, be practical, modern, and convenient, if thought is given to the problems involved. Farm buildings are usually erected for definite purposes, and these purposes should be kept in mind while planning the structures.

The round barn may be adapted to the requirements of various types of farming. The fact that it has met with favor is shown by the replies received to questionnaires sent to all users of this type of barn with whom the author could get into communication. Out of one

¹Credit for much of the work of this circular is due to Mr. H. E. Crouch, who was employed by this department for eleven years and is now the agricultural adviser of Albany county, New York. Mr. Crouch did much in planning the arrangement and construction, and also in superintending the erection of the three round barns built at the University of Illinois. He also wrote much of the description of the details of construction contained in this circular.



FIG. 1.—ROUND BARNs AT THE UNIVERSITY OF ILLINOIS

Barn No. 1 is 60 feet in diameter. The cows run loose in the first story. A Gurler silo measuring 12x56 feet is in the center. No. 2 is a 60-foot horse, tool, and hay barn. There are stalls for eight horses, and a small corn crib is located in the center. The remainder of the first floor is used for the storage of tools. No. 3 is 70 feet in diameter. The cows are in stanchions. A monolithic concrete silo measuring 18x63 feet is in the center.

hundred and twenty-five replies received, no users reported dissatisfaction arising from the arrangement of their barns. They were unanimous in declaring them economical in construction and convenient in feeding and caring for stock. The reports included dairy barns, horse barns, horse and tool barns, general-purpose or combination barns, beef-cattle barns, and hay and grain barns. The majority were combination barns built to meet the requirements of the average general farmer for housing stock and feed. The floor plans show a great variety of arrangements, and often the floor space could be more conveniently and economically utilized.

ADVANTAGES OF THE ROUND BARN

There are several features which favor round-barn construction. Chief among these is the well-known fact that a given area is inclosed with a shorter line in the form of a circle than in any other geometrical figure. Thus a circular wall requires the fewest lineal feet (hence the least material) to inclose a given area; and because of the mechanical advantage in using the principle of the arch and hoop, a much stronger wall can be built, even with lighter construction. This applies to masonry as well as to wood construction. The circular construction takes advantage of the lineal strength of the lumber, which is some twenty times that of the cross-grain shearing strength, thus making possible the use of smaller or fewer pieces than are ordinarily used in a rectangular structure. Another noteworthy feature is that the studs in a round barn may be placed 2 feet to 2 feet 6 inches apart, while for rigidity in rectangular barns they are usually placed as close as 16 inches; yet, the circular wall is the stronger.

A third item of economy in the circular barn is the requirement of less framing lumber. Bracing and cross-ties of bent construction are done away with by the use of bands of boards running around the barn to support the uprights, tying them together as hoops do a barrel. Not a single framing timber larger than a 2x8 is required above the joist. If the siding is put on vertically and a hip roof is built, no scaffolding is required inside or out during construction.

The circular form has the strongest possible construction with the least bracing. If the lumber is rightly placed, much of it will perform two or more functions. Every row of siding boards running around the building serves also as a brace, and the same is true of the roof boards and the arched rafters. Furthermore, not so much strength is needed in the walls of a round barn because all exposed surfaces are convex, both the sides and roof being arched, and thus the best form of construction for resisting wind pressure is secured. The wind, in striking these surfaces, glances off, since it can get no direct hold on the walls or roof as it does on the flat sides or gable ends

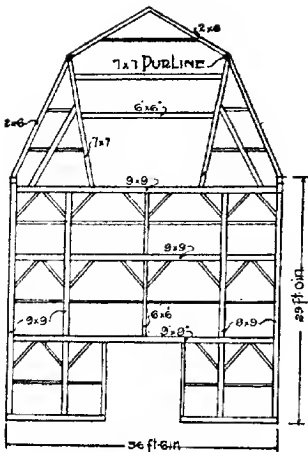


FIG. 2.—SHOWING CONSTRUCTION OF MORTISE-FRAME BARN, END VIEW

of a rectangular structure. Because of its barrel-like construction and its ability to resist wind, the round barn may, with safety, be built higher than a rectangular structure of equal floor area.

A barn on a dairy farm is used twice every day in the year, and for six months each year the cows occupy it almost continuously; so that a large amount of work in the barn is necessary. To meet these conditions on a dairy farm, the round barn has special advantages. With the cows in a circle facing the center, the feeding of silage commences at the chute down which it is thrown, and is continued

around the circle, ending with the silage cart at the chute again, ready for the next feeding. The same principle applies in feeding hay and grain, and in cleaning out the manure.

If cows are to run loose, except at feeding and milking time, the proportionately increased area gained for the cows is considerably

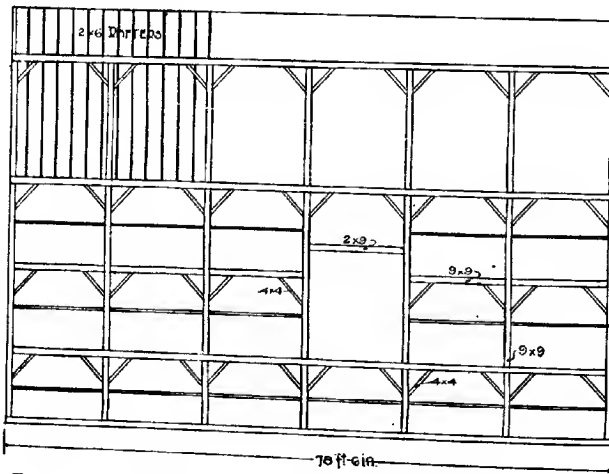


FIG. 3.—SHOWING CONSTRUCTION OF MORTISE-FRAME BARN, SIDE VIEW

greater than that in a rectangular structure with equal wall space or conveniences for feeding, because the feed alley is shorter. The manure can easily be removed from such a barn since the manure spreader can be driven around inside the barn.

The additional mow room is one of the important advantages of the round barn to the modern live-stock farm, where much legume hay is grown. Legume hay cannot be left in the field until needed for feed, or stacked near the barn, as was the common practice with corn stover when it was fed so extensively. If all of the mow room is not required for hay, it can be used to excellent advantage in storing straw, not only keeping it under cover where it will not waste, but also making it much more convenient for bedding, and thereby saving labor.

The large, unobstructed hay mow in a round barn with a self-supporting roof obviates the dragging of hay around posts or over

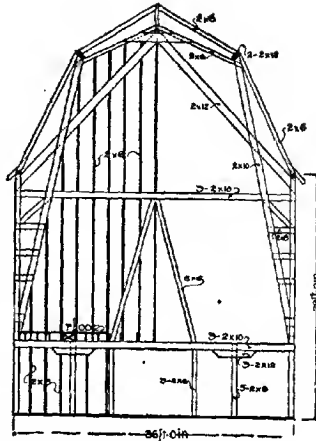


FIG. 4.—SHOWING CONSTRUCTION OF PLANK-FRAME BARN, END VIEW

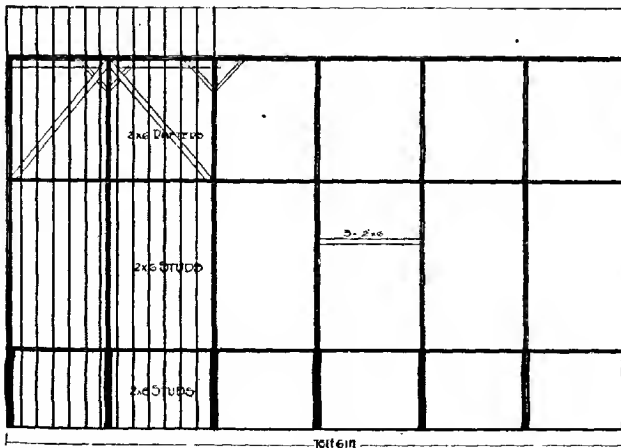


FIG. 5.—SHOWING CONSTRUCTION OF PLANK-FRAME BARN, SIDE VIEW



FIG. 6.—A ROUND DAIRY BARN AND ICE HOUSE ON A FARM WHERE CERTIFIED MILK IS PRODUCED

After the studs were erected, heavy wire fencing was placed around the outside of the studs. Building paper was then put on this and another layer of wire fencing stapled on. The barn was then covered with stucco made from cement and finely crushed stone, making a tight, economical, permanent building.



FIG. 7.—ROUND CALF AND HORSE BARN ON THE SAME FARM AS THE BARN SHOWN IN FIG. 6 AND BUILT IN THE SAME MANNER

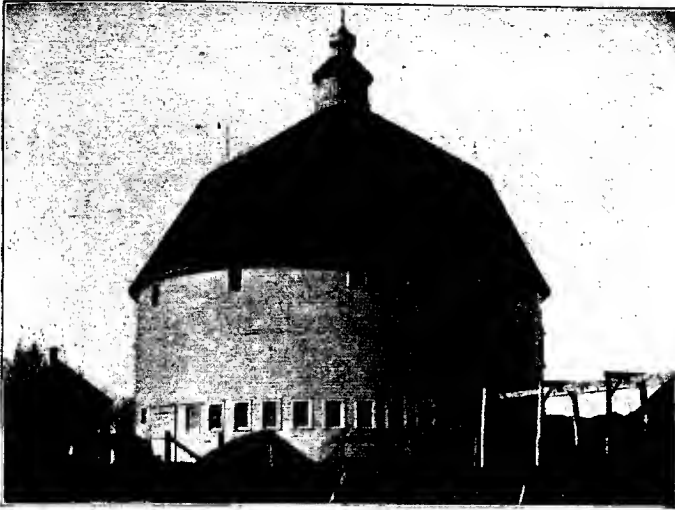


FIG. 8.—A DAIRY BARN SIXTY-FOUR FEET IN DIAMETER, WITH DRIVEWAY TO THE SECOND FLOOR



FIG. 9.—A WELL-PROPORTIONED SIXTY-FOOT ROUND DAIRY BARN, WITH GURLER SILO IN THE CENTER AND A DRIVEWAY TO THE SECOND FLOOR

girders. The hay carrier may run on a circular track around the mow, midway between the silo and the outside wall, and drop the hay at any desired point. In barns having a diameter up to 60 feet, considerable saving of labor results from the fact that it is necessary to mow the hay only a few feet.

The ventilating flues that remove the foul air are especially effective in the round barn because their great height and freedom from bends creates a strong suction. Since the ventilating flues are in the center next to the silo they are not in the way either in the stable or in the mow. In many cases the hay and silage chutes are used for ventilation.

DISADVANTAGES OF THE ROUND BARN

A disadvantage in circular construction is that additions cannot be made so readily as in the case of rectangular buildings.

The objection is frequently raised that a round barn is difficult to light. This difficulty can be largely overcome, however, in a barn 90 feet or less in diameter, with a ceiling 9 feet or more in height, by placing a sufficient number of properly spaced windows well up toward the ceiling (see Fig. 10). In barns over 90 feet in diameter, some

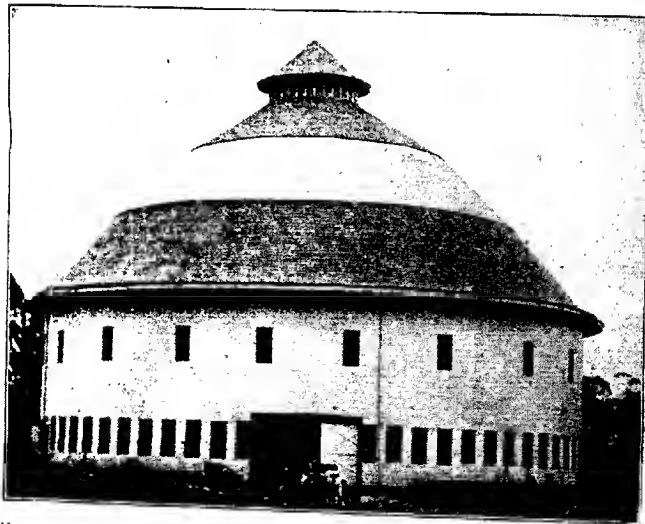


FIG. 10.—A FINELY PROPORTIONED DAIRY BARN, WITH AN ABUNDANCE OF LIGHT

This barn is 88 feet in diameter, 25 feet high at the eaves, and 65 feet at the center. It has a concrete silo measuring 14x54 feet, and a driveway to the second floor.

special provision must be made to admit light to the center, if proper lighting is to be secured.

The objection has also been made that rectangular objects cannot be placed in a circle without waste of space. This does not apply to a dairy or horse barn for the following reasons: first, cows and horses are wedge-shaped, requiring less space in front than at the rear; second, the storage capacity for hay and grain depends upon cubical content alone; third, silos should always be circular no matter where built.

The objection may be raised concerning round barns large enough for two rows of cows, that the row headed out does not use the space as economically as in the rectangular form, because a cow needs more width at the rear of the platform than at the manger. This is true of the cows headed out, but in barns containing two rows of cows, the inner row (which accomodates only about one-third of the cows) is usually the one headed out, and loss of space here is more than counter-balanced by the fact that the larger number of cows in the outer circle use the space much more economically than in the rectangular barn.

Specially designed hay tracks are required; and unless attention is given to their proper installation, difficulty may be experienced in putting in the hay.

The round barn does not make so good a wind break for the stock when turned out-of-doors. This disadvantage can be partially obviated by building a high board fence radiating from the barn to shelter the stock from the cold winds.

ROUND AND RECTANGULAR BARNs COMPARED

COST OF MATERIAL

In order to compare the amount and cost of material in round and rectangular barns, the figures in the accompanying table have been carefully worked out by an expert barn builder. Round barns 60 feet and 90 feet in diameter, constructed entirely of wood, are compared with both plank- and mortise-frame rectangular barns containing the same number of square feet of floor space. Since the most practical width for a rectangular dairy barn is 36 feet, the length depends upon the number of square feet required in the barn.

Figs. 2, 3, 4, and 5 are end and side views of plank-frame and mortise-frame barns, showing details of construction. The total number of feet of each kind of lumber required, together with comparative prices, are given in the table. Since the proportions of the different kinds of lumber and shingles vary for the different barns, in order to draw an exact comparison it has been necessary to use the total money value of the lumber as the basis of comparison. The lumber values are the best average prices that could be obtained. As the same prices are

COMPARISON OF COST OF MATERIAL IN ROUND AND RECTANGULAR BARN OF THE SAME AREA AND WITH TWENTY-FOOT POSTS:
NOT INCLUDING FOUNDATION AND SILOS

Materials	Round barn 60 feet in diameter	Rectangular barn 36 x 78½ feet	
		Plank frame	Mortise frame
Framing lumber	13,976 ft. @ \$33 = \$461.20	19,833 ft. @ \$33 = \$654.49	29,074 ft. @ \$33 = \$959.44
Sheathing, siding, and flooring.	12,971 ft. @ \$35 = 453.98	15,335 ft. @ \$35 = 537.43	15,335 ft. @ \$35 = 537.43
Shingles	44,000 ft. @ \$ 4.50 = 198.00	45,000 ft. @ \$ 4.50 = 202.50	45,000 ft. @ \$ 4.50 = 202.50
Bolts		20.88	
Total cost of lumber	\$1,113.18	\$1,415.30	\$1,699.47
Proportional cost	100%	127%	153%
Content, cubic feet	117,669	117,138	
Materials	Round barn 90 feet in diameter	Rectangular barn 36 x 176¾ feet	
		Plank frame	Mortise frame
Framing lumber	30,899 ft. @ \$33 = \$1,019.67	38,815 ft. @ \$33 = \$1,280.89	59,481 ft. @ \$33 = \$1,962.87
Sheathing, siding, and flooring.	22,375 ft. @ \$35 = 783.13	28,547 ft. @ \$35 = 999.15	28,547 ft. @ \$35 = 999.15
Shingles	97,000 ft. @ \$ 4.50 = 435.50	102,000 ft. @ \$ 4.50 = 459.00	102,000 ft. @ \$ 4.50 = 459.00
Bolts		26.76	
Total cost of lumber	\$2,233.30	\$2,765.50	\$3,421.02
Proportional cost	100%	124%	153%
Content, cubic feet	322,932	270,570	

The prices here given were the average for central Illinois for the years 1915-16.

used thruout this publication; all comparisons on a cost basis are true, altho with the different prices that will occur in different localities and at different times, the proportional costs of the different types of construction will vary from those shown here.

Since a silo cannot be economically or conveniently built inside of a rectangular barn, the comparison is made between barns without silos, altho one of the advantages of round-barn construction is the deep silo which can be built so economically in the center.

Two dairy barns, to be fairly compared, should not only have equal floor areas, but should each accommodate the same number of cows on the platform. The 60-foot round barn shown in the table has a floor area equal to the rectangular barn measuring 36 x 78½ feet, but it accommodates two less cows. The 60-foot round barn has space for forty cows, allowing each cow an area 3 feet 6 inches wide at the rear of the platform and leaving room for two passageways; while in the rectangular barn forty-two cows can be accommodated and space allowed for two 3-foot passageways across, since only 3 feet 4 inches of platform space need be allowed for each cow. The advantage of the rectangular barn in having stall room for two more cows than the round barn is more than offset, however, by the fact that the round barn contains space in the center for a silo 18 feet in diameter.



FIG. 11.—COWS IN SWING STANCHIONS IN A SEVENTY-FOOT ROUND BARN

The advantage of additional width at the rear of the stall is apparent.

The floor space and the cubical content of the round barn and the rectangular barn of the dimensions stated are practically the same. Taking the round barn as the basis of comparison, the bills of material show an increase in cost of 27 percent for the plank-frame rectangular barn and 53 percent for the mortise-frame. The 60-foot round barn contains $188\frac{1}{2}$ lineal feet of wall and the rectangular barn 225 feet, an increase of 22 percent in length of outside wall and foundation in the rectangular structure.

The 90-foot round barn, with 20-foot posts, has a mow capacity of 33,000 cubic feet in excess of that of the rectangular barn measuring $36 \times 176\frac{3}{4}$ feet and having 20-foot posts. This excess capacity of 33,000 cubic feet would accommodate 66 tons of hay, or as much as the entire mow of a rectangular barn measuring 32×36 feet, with 20-foot posts, and with a stable below. The rectangular barn $176\frac{3}{4}$ feet long will hold one hundred cows, allowing each cow a space 3 feet 4 inches in width and providing for three passageways of 3 feet each across the barn.

The lumber bill for the one-hundred cow rectangular barn is increased over the cost of the one-hundred cow round barn 24 percent by the use of the plank-frame construction and 53 percent by the use of the mortise-frame. The 90-foot round barn requires only 283 lineal feet of outside wall, while the rectangular barn requires 426 feet, an increase of 50 percent in wall and foundation needed to inclose the rectangular area.

The outside walls of the round barn, having a smaller surface, require less paint, and this means a proportional saving in upkeep in after years.

The one-hundred cow rectangular barn requires nearly one-fourth to over one-half greater expenditure for lumber, according to the manner of construction, than is required by the comparable round barn.

COST OF CARPENTER WORK

Definite data upon the relative cost of carpenter work on round and rectangular barns containing the same floor area and mow capacity are difficult to obtain because few men have built both round and rectangular barns of the same size. Answers to letters written to all men who were known to own or to have built round barns, asking for the relative cost of carpenter work, are given below so far as they contain any information on this point.

1. "As to labor, one can build a circular barn much cheaper, because anyone that can use a hammer and saw can work on a circular barn. All heavy timbers, as sills, purline plates, etc., are nailed together one inch at a time."
2. "The carpenter work on a round barn 50 feet in diameter containing 1,964 square feet of floor space with 18-foot posts cost \$150, while the carpenter

work on a rectangular barn 30x45 feet containing 1,944 square feet of floor space with 18-foot posts cost \$140. In both cases the work was figured at 30 cents per hour."

3. "From bids that I received for the carpenter work on the rectangular barn and round barn covering the same floor space, it was about \$75 cheaper for the round barn."

4. "The cost of carpenter work on a round barn is practically the same as a rectangular one of the same size if you have one carpenter of experience."

5. "In my opinion there should be no difference to speak of in the amount of labor needed to construct round and rectangular barns of the same capacity. I believe that carpenters who have had some experience in circular construction would erect the circular barn cheaper than the rectangular."

6. "It is my belief that the carpenter work required in building a round barn would be about the same as that of building a rectangular one of the same capacity."

7. "I think the carpenter work would cost as much on a round as a rectangular barn, but the lumber does not cost as much."

8. "Our experience, tho limited, has been that the round building will cost from one-fourth to one-third more for the labor of construction than a rectangular building containing an equal cubic space."

9. "If a good carpenter had plans to follow, I do not see why he should have any trouble in building a round barn, and believe the cost of labor would be less on a large round barn than on a rectangular barn containing the same number of cubic feet."

10. "I built a barn 40x60 feet containing 2,400 square feet with 18-foot posts, the carpenter work costing \$250. The next year I built a round barn 60 feet in diameter containing 2,826 square feet with 20-foot posts and the carpenter work cost me \$240. The round barn contained 15 percent more floor area and the carpenter bill was 4 percent less."

11. "When I wanted to build my barn I had a bill of lumber made out for a 40x80-foot barn containing 3,200 square feet of floor space and the lumber dealer wanted \$1,500 for the lumber. Then I had a bill made out for a round barn 72 feet in diameter containing 4,069 square feet of floor space and the lumber was an even \$1,000, which was quite a difference, so I built the round barn. The carpenter wanted the same price for his labor on the round as the rectangular barn."

12. "In reference to the comparative cost of the carpenter work in erecting round and rectangular barns, I long ago found that it was a whole lot easier to build a round barn than a rectangular one of the same relative dimensions. I would say about 10 percent less cost for carpenter work on the round barn, especially where carpenters have had experience with circular construction."

It would seem from the above answers that there is a saving in the cost of carpenter work on the round barn over the rectangular barns, where the head carpenter has had any experience in building round barns. Of the twelve replies, two say the carpenter work costs more on a round than on a rectangular barn, four say it is the same, and six say it is less.

ARRANGEMENT OF THE ROUND BARN

The simplest plan for a round dairy barn is that designed so that the cows may run loose. In such a plan it is only necessary to provide convenient means for feeding and cleaning. Allowing the cows to run loose is an excellent method so far as their health, comfort, and production is concerned. The manure does not waste from leaching, as when lying exposed to the weather. This method saves the labor of cleaning the stable daily, as the manure may be allowed to accumulate for a time and then, whenever convenient and when the soil is in the best condition to receive it, it may be loaded into the spreader and hauled directly upon the land. However, some objection has been raised to this method on the ground that cows become dirty if sufficient bedding is not used, thus affecting the quality of the milk.

With this method of housing, the cows may be placed in rigid stanchions at feeding and milking time. It must be distinctly understood, however, that rigid stanchions are strongly condemned as a cow tie when the cows are to remain in them all night, but if used merely to hold the cows during feeding and milking they are both economical and convenient. Fig. 13 shows a plan for such an arrangement. Gates hung on posts at the outside wall and swung around to the manger are used to make box stalls when these are needed. The large doorway in the cow stable can be closed by slatted gates, thus giving the cows an abundance of fresh air, and sunshine on bright days, without putting them out of the barn in cold weather or when the yard is muddy.



FIG. 12.—BARN No. 1, UNIVERSITY OF ILLINOIS, WITH DRIVEWAY THRU SECOND STORY

Fig. 15 shows an arrangement of a 60-foot barn which provides stanchions for 40 cows and a silo of sufficient capacity for a herd of this size.

If there is to be a brick basement, or first story, and 20-foot studs on top of this, it is often desirable to drive into the barn on the second floor, thus enabling the entire first floor to be given to the use of stock. Fig. 16 shows a second-floor plan for a 60-foot barn with such an arrangement and a conveniently placed set of approaches. If grain bins are built on the first floor next to the silo, they should be placed on the same side as the drive so that they may be filled directly from the wagon driven in on the mow floor.

With a silo located in the center of a round barn, provision for filling is most readily made by means of a drive thru the barn. Fig.

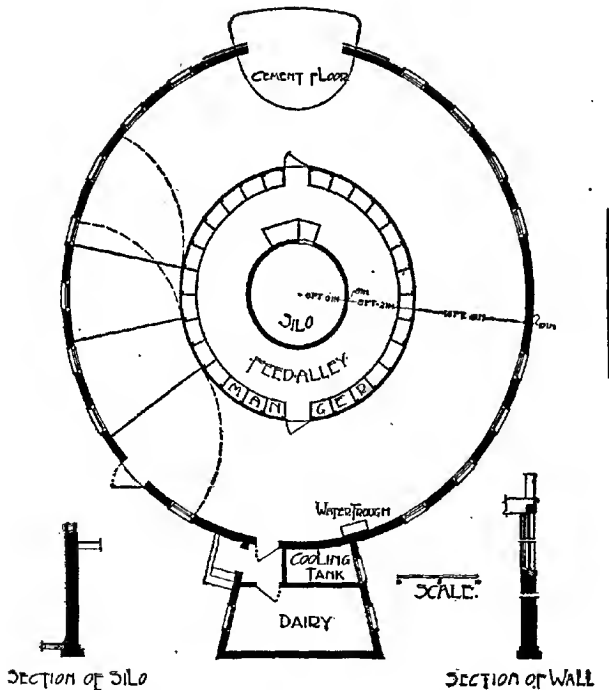


FIG. 13.—FIRST-FLOOR PLAN OF BARN NO. 1, UNIVERSITY OF ILLINOIS

This barn is 60 feet in diameter, with 2,200 square feet of floor space in which the cows run loose except at milking time. There are stanchions and mangers for twenty-eight cows. The gates hinged to the wall of the barn are swung to the mangers when box stalls are needed.

18 shows the location of the silage cutter and how the load of corn may be driven in when the drive is on the second floor. This method lessens by about ten feet the height to which the silage must be raised, and permits the running of the cutter belt out thru the driveway door. If there is no drive thru the barn, some provision must be made to get the load of corn up to the cutter. Fig. 17 shows a first-floor plan in which the empty wagon must be backed out.

In planning a barn for dairy purposes, frequently some provision should be made for taking care of the increase in the size of the herd. After a round barn has been built, however, it is difficult to increase its capacity. On smaller farms, with herds of twenty or less cows, a 60-foot general-purpose round barn, in which the cows are placed on one side, will leave the remaining space for temporary use for horses, tool room, calf pens, or box stalls. As the dairy herd increases in number, the horse stalls, pens, and box stalls may be removed, eventually providing accommodations for forty cows. Fig. 17 shows such an arrangement. If sufficient space cannot be obtained by such methods, a rectangular addition of adequate size may

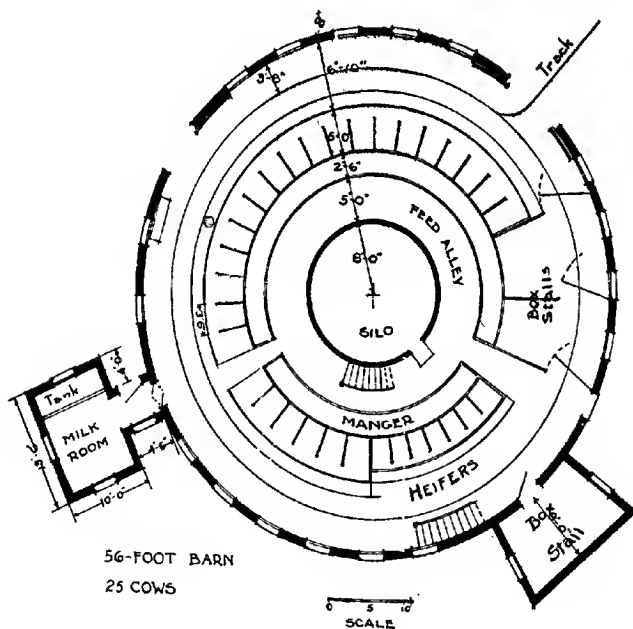


FIG. 14.—A ROUND BARN THAT IS GIVING SATISFACTION

A saving of space could have been made by reducing the width of the walk behind the cows.

be erected on the side of the barn. If still more space is needed, a second round barn may be built; and if desired the two barns may be connected by a rectangular portion still further increasing the floor space.

A 70-foot round barn should accommodate fifty cows in one row of stanchions. The space next to the silo may be used for calf pens, etc. (Fig. 19). Such an arrangement should be satisfactory also for an 80-foot round barn in which fifty-eight cows could be stanchioned

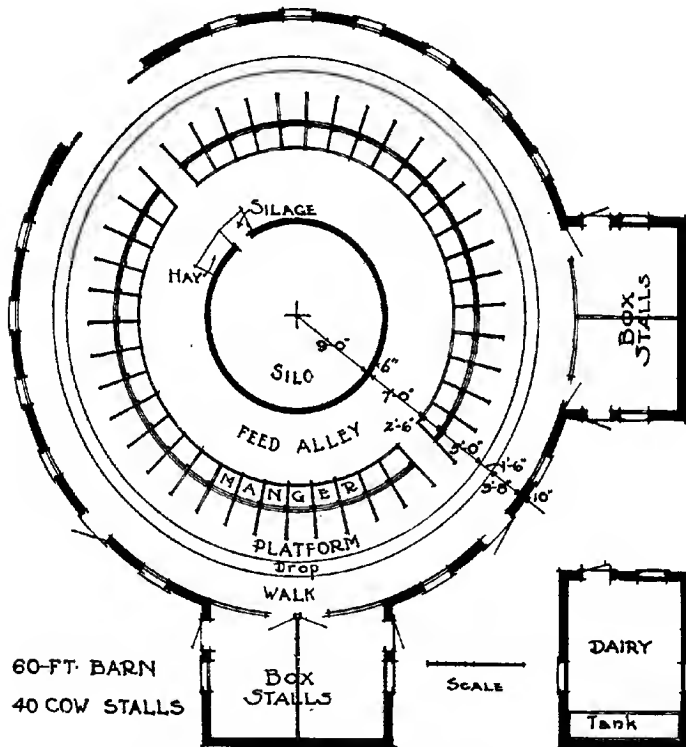


FIG. 15.—BOX STALLS ARRANGED UNDER THE DRIVEWAY APPROACHES TO THE SECOND FLOOR. THE DAIRY ROOM IS BUILT SEPARATE FROM THE BARN

To supply this sized herd and the necessary young stock with silage for eight months would require a 370-ton silo, or one 18 feet in diameter and 56 feet deep. With a 7-foot feed alley and a 2½-foot manger, the circle at the stanchions would be 38 feet in diameter, or 119½ feet in circumference; allowing 4¼ feet for two passage ways, the stalls would be 2 feet 10½ inches wide at the stanchion, and 3 feet 6 inches at the drop.

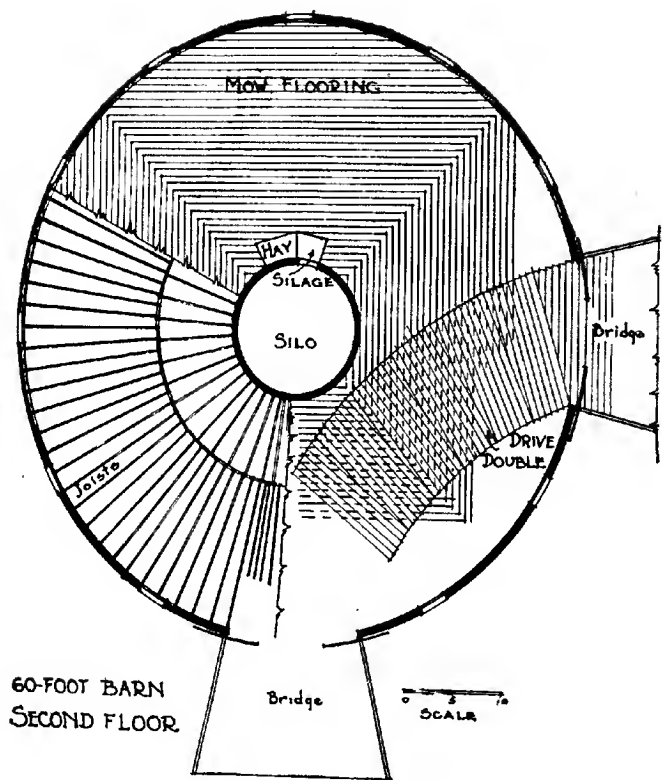


FIG. 16.—RADIAL ARRANGEMENT OF SECOND-FLOOR JOISTS

The number of joists under the drive is doubled. The mow flooring is 1x8 inch ship-lap laid in four directions. The floor of the driveway is doubled.

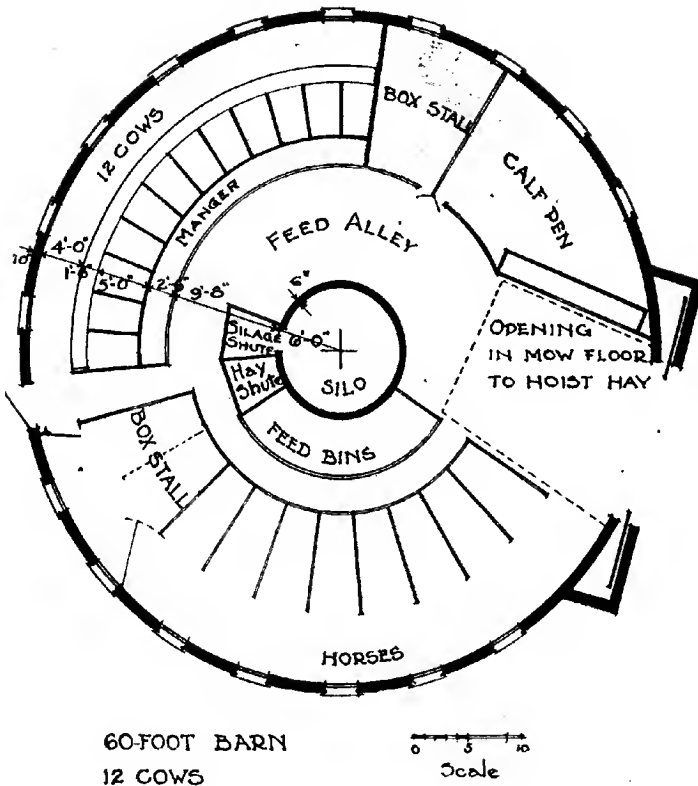


FIG. 17.—GENERAL-PURPOSE ROUND BARN

By removing the box stalls, the number of cow stalls may be increased to twenty and still leave room for eight horse stalls and a calf pen.



FIG. 18.—INTERIOR OF BARN NO. 1, UNIVERSITY OF ILLINOIS

Second floor, showing silo and location of ensilage cutter (team unhitched to show cutter).

and sufficient space be left for box stalls and calf pens about the silo. A round barn 90 feet in diameter will accommodate one hundred cows in two rows of stanchions (Fig. 21).

Where it is desired, the cows may be allowed to run loose and a section of the barn partitioned off for a milking stable, thus combining the advantages of the loose barn, separate milking stable, and ample storage capacity in one structure (Fig. 20).

The width of the stalls for Holstein cows in a round barn should vary from 3 feet 4 inches to 3 feet 8 inches at the gutter, and for Jersey cows from 3 feet to 3 feet 4 inches, according to the size of the cows. The width of the walk back of the cows will, to a certain extent, determine the economy with which the space in the round barn is utilized. In a barn 70 feet in diameter, a foot saved in the width of the outside walk behind the cows will make possible the addition of more than two stalls in the circle. This shows the importance of pushing the stalls back as near the outer wall as possible, if the space in a round barn is to be most economically used. At the same time the walk back of the cows should not be so narrow as to make it crowded or inconvenient.

The locating of a feed room on the second floor of the barn, es-

pecially if there is a driveway to that floor, is often convenient. Barn No. 3 (Figs. 1 and 39) has such a feed room containing a corn sheller, feed grinder, motor, and three feed bins for ground and mixed feeds next to the silo, from which the feeds may be drawn thru chutes into the feed alley below. The room also contains an elevator which is used for elevating feed into storage bins above. These bins have hopper bottoms so that the grain may be run directly from them thru chutes into the grinder.

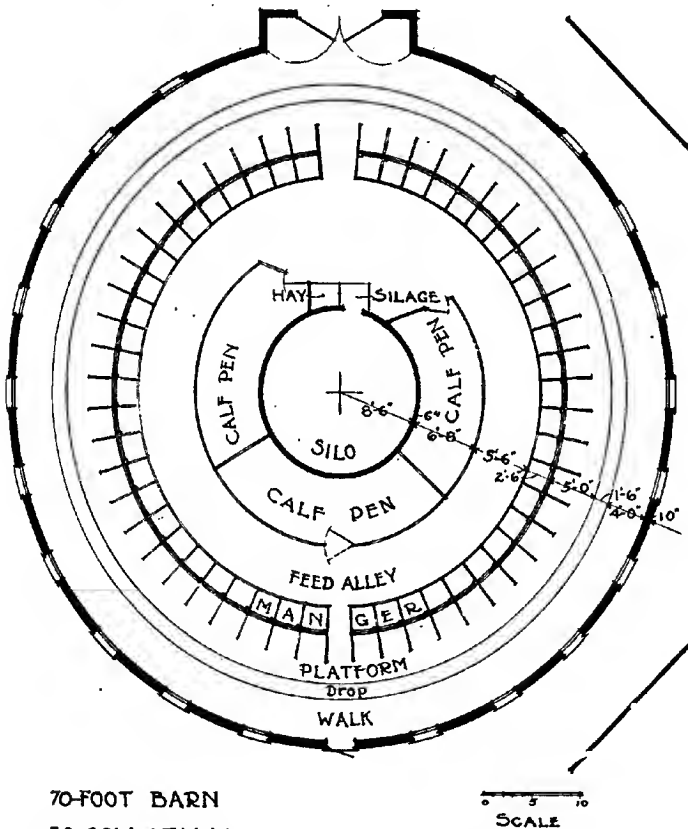


FIG. 19.—USING THE SPACE ABOUT THE SILO IN A SEVENTY-FOOT ROUND BARN, FOR CALF PENS

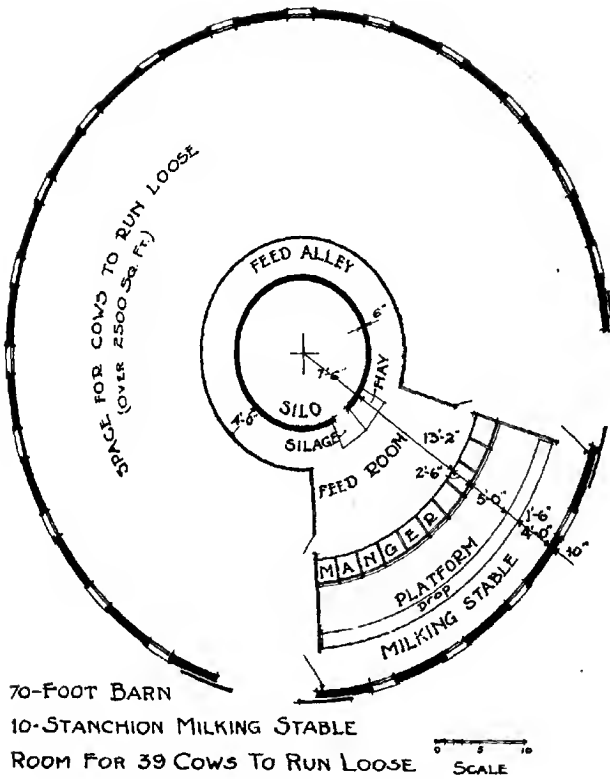
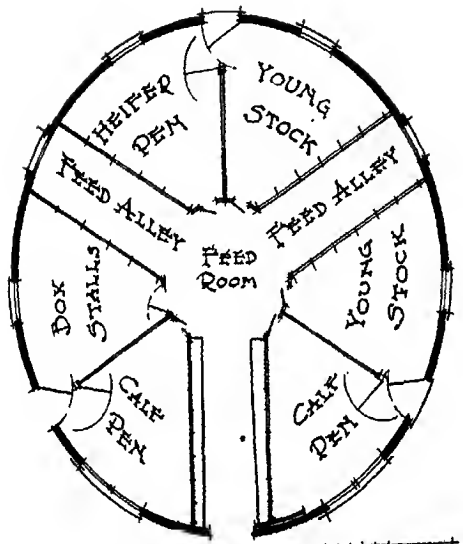


FIG. 20.- COMBINING THE ADVANTAGES OF A SEPARATE MILKING STABLE
AND RUNNING THE COWS LOOSE



35-FT. CALF BARN SCALE

FIG. 22.—CALF BARN THIRTY-FIVE FEET IN DIAMETER

The pens accommodate 14 calves, 12 head of young stock, and 10 yearling heifers.

HOW TO BUILD ROUND BARN

The difficulties most commonly met with in carrying out plans for a round barn are those involving mechanical features of framing or laying out and building up the parts without loss of time.

Upon locating the center of the structure, an iron pipe or pin should be driven into the ground. This pin should be higher than any part of the ground included within the circle marking the bounds of the structure. Over this is placed a free-moving ring attached to a wire, some four to six inches longer than one-half the diameter of the barn; for example, 30 feet 4 inches for a barn 60 feet in diameter. With a sharp-pointed pin attached to the outer end of this wire, a circle is drawn, care being taken to keep the wire tight and level and the pin at right angles thereto. The line thus drawn marks the outer edge of the foundation, and the excavation may be made accordingly. On rolling or uneven ground especial care must be taken to have pins of sufficient length to permit the wire being kept level and tight without pulling the center pin out of plumb.

Footings and foundations of sufficient strength to support the structure should be put below the frost line. Concrete is well adapted to this purpose. Trenches may be used below ground for forms. Above ground, forms bent to a circle of the desired size are required. Stakes driven firmly into the ground every few feet on both sides of the trench may be used as supports, and the form nailed to the stakes in such a manner as to place the inner surface of the forms in a perpendicular position exactly at the desired distance from the center (Fig. 23). These walls may economically be carried three or four feet above the floor level, because windows may well be placed above this height.

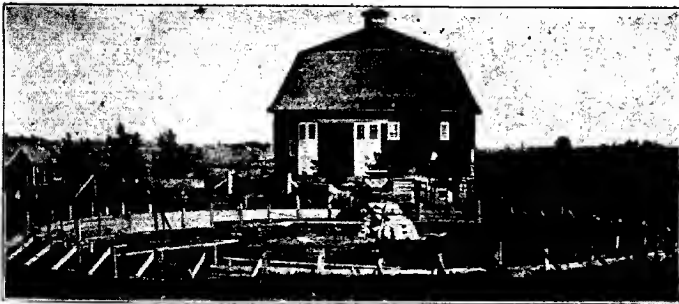


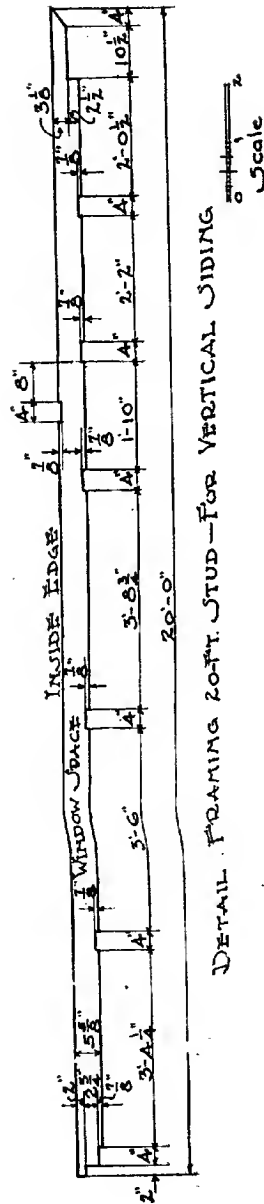
FIG. 23.—WOODEN FORMS IN PLACE FOR CONCRETE FOUNDATION FOR BARN NO. 2, UNIVERSITY OF ILLINOIS

The concrete mixer is at the opposite side of the circle. Barn No. 1 in the background.

The top of this wall may be finished to receive a sill to which the super-structure is fastened, or to receive the ends of the studs directly into holes in its top. If the sill is used, bolts to which it may be attached should be imbedded at regular intervals. If no sill is used, holes 2 inches deep in the top of the wall, large enough to receive a 2x2-inch end of a stud, should be made by inserting temporary blocks at the required intervals. The spacing of the studs will depend upon the size of the building. In a barn 60 feet or less in diameter, 2 feet 6 inches is close enough for the 2x6-inch studs and may do on a 70-foot barn with 20-foot studs when the mow is not over 12 feet deep at the eaves. In this case, it might be well to use a 2x6-inch built-up band inside of the studs just below the second-floor joists, instead of the regulation 2x4-inch band upon which the floor joists rest. For barns larger than the above, 2 feet on centers is better spacing for the studs. If the studs are to be set in holes on the foundation, the base of each stud should be notched on the outside edge one inch deep and 6 inches from the end. At a point two inches from the end another notch 3 inches deeper should be cut from the same side; thus leaving on a 2x6-inch stud a projection 2 inches square to fit into the hole in the foundation. The outer edge of the stud, when placed, should be on a line with the outer edge of the wall. Into the 1x4-inch notch left on the outside of the stud immediately above the wall level, a 1x4-inch strip (the first half of the first band) is to be nailed. The second 1x4-inch strip of this band when nailed on will then project $\frac{7}{8}$ inch beyond the foundation wall. Thus, when the vertical siding is put on, an air space is left between the siding and the wall, which prevents rotting; and if the siding is carried one-half inch or more below the band, it provides a drip which makes a water table unnecessary.

The distance between the bands or nail ties which encircle the studs should be determined with reference to the location of the windows and the strength required in the structure. On a barn with studs 20 feet or less in height, a distance of 4 feet between the bands will be satisfactory, and 1x4-inch notches should be cut at the desired intervals in the outer edges of the studs to receive the first strip of the bands. All cutting of notches should be done before the studs are erected. The top of the stud should be framed to receive the first members of the top plate, and extend above this plate far enough to allow the rafters to be nailed to them. Detail of notches for a 20-foot stud are shown in Fig. 24.

Ordinarily a barn 60 feet in diameter requires a 4x4-inch plate, so that the stud will be notched at the top on the outside to receive a 2x4-inch portion of this band. The width of this band should be greater on larger barns.



F.g. 24

The first stud should be erected by dropping the 2x2-inch end into the mortise in the foundation, or by placing and nailing the end of the stud in position on the sill, and then plumbing and staying it and each succeeding stud in position by means of braces until about six studs are erected. Then the first strip of the second band is nailed into the notches in the studs, at points previously located upon the strip by bending it around the wall against false blocks set in the openings made in the wall for the foot of the studs, and the position of the studs marked on the band. As each succeeding stud is put in position the band is nailed fast. Thus, by marking the first strip of each succeeding band and nailing the studs as indicated by the marks, the studs are kept a uniform distance apart from top to bottom and no plumbing in this direction is needed. Each stud is, however, plumbed in the other direction and stayed or braced into position before the band is nailed on. The bottom band is not put on until all other bands are placed.

The first strips of some of the other bands might well be started before many studs are up, because the sooner the bands are placed, the less bracing the studs will require. The bands should be made of long, clear lumber and started on different studs, the second member of each band being nailed down close to the first and put on so as to break joints. The lower bands should be put on first in order that the men can stand on these while nailing on the ones above, thus doing away with the need of scaffolding.

If horizontal siding is used, no bands are required; but to notch the studs and put in a one-inch band will be an advantage in erecting the studs. Horizontal siding is not so easily applied nor so satisfactory as the vertical, because the boards tend to spring out at the ends and pull loose from the nails.

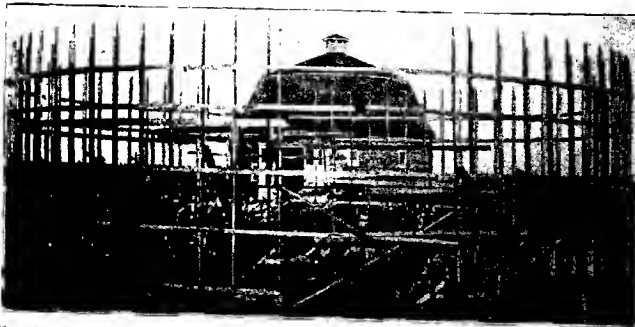


FIG. 25.—BARN NO. 2, UNIVERSITY OF ILLINOIS. STUDS ERECTED ON FOUNDATION AND HOOPS IN PLACE TO RECEIVE VERTICAL SIDING

The openings for small doors should be cut thru the studs and bands at such places as needed. The studs at the sides of the openings for the large doors should be strongly stayed and braced. The curved girder above a large opening should be built on the floor and raised into position; the short studs above can then be placed on this, and the bridging built into place as shown in Fig. 26.

After all the studs are placed and the outer bands nailed on, the inner band, or floor plate, made of two 1x4 or 1x6-inch pieces, is built into the $\frac{7}{8}$ -inch notch on the inside of the stud, for the mow floor joists to rest upon. These floor joists are to be notched with a 1-inch notch 6 inches long on the under side, and placed in position, one for each stud, so that the outer end when nailed to the stud will have the shoulder of the notch pressing firmly against the supporting band. The inner ends are to radiate toward the center, to be evenly spaced, and to rest upon a built-up, circular girder, which is supported by posts placed according to the arrangements of the floor plans. This inner, circular girder may be built up of 1-inch boards entirely on the floor and raised into position on top of the posts, or the first two mem-

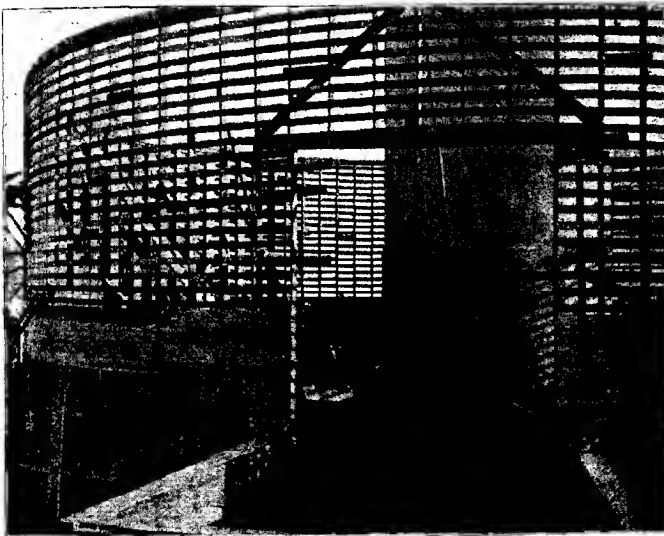


FIG. 26.—BARN NO. 3, UNIVERSITY OF ILLINOIS, SHOWING THE STUDS AND SHEATHING OF THE SECOND STORY

The first five feet of the sheathing is solid, to prevent shingles from being knocked off from the inside. Above this, the sheathing consists of 1x4-inch lumber placed 4 inches apart. The shingles are put on in double courses, 8 inches to the weather. The bracing to take the weight of the roof over the doorway is shown.

bers of the center course may be nailed together on the floor and then raised into position on the posts, after which the nailing on of the outer members is not a difficult task. Care must be taken, however, to prevent splitting, for this weakens the girder. The boards used in the girder should be of clear wood, and as long as possible (Fig. 27).

The joists should be placed before the siding is put on, so that they may be used to stand on in building the upper portion of the barn. The joists of the inner circle converge toward the center. The outer end is to rest on the circular girder, and the inner end, when there is a silo in the center of the barn, is to rest upon a similar girder at the silo or upon a projecting ledge on the silo. This inner circle of joists will need to contain only half as many as the outer circle. If there is no silo in the center of the barn, the joist in the center portion should run directly across the space enclosed by the circular girder, providing it is not too long, as this method is somewhat easier and more economical than the radial arrangement. The joist should be slightly notched, however, to fit tightly over the top edge of the circular girder, and nailed firmly into place. If there is to be a drive on the second floor, the joists under the driveway should be increased in number or strengthened, and the flooring should be at least two inches thick. The flooring may be laid immediately after the joists are in place. The mow floor may be made of 1x8-inch ship-lap, laid in four directions (Fig. 16).



FIG. 27.—BARN NO. 3, UNIVERSITY OF ILLINOIS, SHOWING THE 6x12 BUILT-UP GIRDER TO CARRY THE FLOOR FOR THE SECOND STORY



FIG. 28.—PUTTING THE VERTICAL SIDING ON BARN NO. 2, UNIVERSITY OF ILLINOIS

The men are working from the hoops and floor joists, making scaffolding unnecessary.

Placing the vertical siding is most readily accomplished if one man works from the second-floor, or upper, bands, and one works from the ground, or sill. When more than one length of siding is required, the upper section should be left off until the roof is completed. This affords means of ready access to the roof while shingling. The last few boards of the top course of siding may be readily put into place from a ladder, the others having been nailed from the bands. After the floor has been laid and the top plate built into the notches sawed in the tops of the studs, the rafters may be erected.

ROOF CONSTRUCTION

The failure to make use of the principle of the arch in roof building is a mistake in round-barn construction. In fact, the lack of a properly constructed, self-supporting roof has been the chief factor in keeping the round barn from being more generally used, and its coming into prominence at the present time is due to the fact that different types of self-supporting roofs have been devised. The length of the rafters is determined by the size of the barn and the style and pitch of the roof; and this determines the area to be shingled and also the shape of the dome. Generally speaking, the one which is nearest spherical in shape is the most rigid and makes the best appearing roof. It also leaves more room for the suspension of the track in such a manner as to insure the hay carrier swinging its load clear of the rafters.

In laying the shingles there is no need to narrow them toward the top until the diameter of the course being laid is 25 feet or less. Little extra labor will then be incurred in trimming them. The shingles should be laid sufficiently far apart to prevent buckling when wet. Those on the first set of rafters of a two-hipped roof may well be laid 5 inches to the weather, and on the second portion $4\frac{1}{2}$ inches to the weather; but if the upper portion of the roof is less than a third pitch, the shingles should be laid not more than 4 inches to the weather.

There are four different types of circular roofs being successfully used at present. The type shown in Figs. 9 and 23 is satisfactory for barns 60 feet or less in diameter and having a silo in the center. The rafters for this roof are of 2x6-inch lumber framed and nailed together on the ground. Four of the rafters come to a point in the center of the barn (Fig. 29); four others have to be cut a little short so that they will fit into the angle formed by the intersection of the first four; and the next eight extend to a point halfway from the silo wall to the center, the ends being held in place by headers cut in between the first eight rafters. The remainder of the long rafters rest on the silo. In the lower section of the roof there are twice as many rafters as in the upper. The upper ends of these lower rafters are held by headers nailed between the long rafters at the hip in the roof. The long

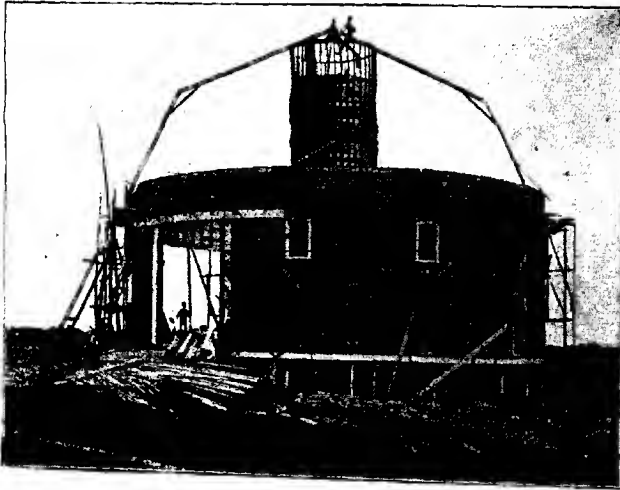


FIG. 29.—BARN NO. 1, UNIVERSITY OF ILLINOIS, SHOWING HEIGHT AND CONSTRUCTION OF SILO

Siding completed, and four main rafters in place.

rafters are braced at the hip joint by two 1x4-inch pieces, 8 feet long, nailed one on each side of the rafter. From between these pieces a 2x4-inch piece with one end properly framed, extends to the union of the two rafters, and over this on either side is nailed a short piece of 1x4-inch lumber cut to fit over the joint of the rafters. The roof sheathing is of 1x2-inch lumber, sawed as long as possible. This is nailed on flatwise and horizontally. Each piece encircling the roof answers the same purpose as a hoop on a barrel, and the strength and rigidity of the roof depends quite largely on these sheathing strips. As a result of this method of putting on the sheathing strips, there is no outward thrust at the eaves. The sheathing is spaced according to the distance desired to lay the shingles to the weather. The shingles are then laid by the sheathing, making a chalk line unnecessary.

A second type of roof in quite general use is very similar to the one described above, but instead of having rafters in the lower section of roof that extend only to the hip, all extend to the center and end against a heavy circular plate at the base of the cupola. The upper portion of the rafters are of 2x4-inch lumber instead of 2x6. The hip joint is held by two short pieces of 1x8-inch lumber sawed to fit over the joint on both sides of the rafters, and nailed securely. This makes a very rigid roof which is entirely self-supporting. In building this type of roof it is necessary to have either a silo or a scaffold in the center of the barn, from which to work.

For barns 60 feet or more in diameter, the two-hip roof shown in Figs. 31 and 39 is preferable. This roof differs from the roof previously described in having circular purline plates built in at the hip joints. There are three sets of rafters. The roof is self-supporting from the start. The first set of rafters will hold its position independently of the second set, and the second set independently of the third. The roof can be erected without the use of a silo or staging of any kind in the center of the barn. For a 60-foot round barn, the first set of rafters can be 2x6-inch lumber, 14 feet long; the second set 2x6, 12 feet long; and the third 2x6, 9 feet long. All are notched $1\frac{1}{8}$ inches wide and $\frac{1}{2}$ inch deep for the sheathing strips, at intervals varying with the distance at which the shingles are laid to the weather. A V-shaped notch is cut in each end of the first and second sets of rafters and in the lower end of the third set. The other end of the third set has a plumb cut. These notches fit over two sides of the plate.

The sheathing is $1\frac{1}{8} \times 1\frac{3}{4}$ inches in size, being sawed out of $1\frac{3}{4}$ -inch cypress plank. It is put on horizontally and edgewise, with the edge inserted in the notches in the rafters. This method allows the use of 12d nails, which are driven vertically thru the sheathing into



FIG. 31.—BARN NO. 2, UNIVERSITY OF ILLINOIS, COMPLETED
This barn is 60 feet in diameter, with vertical siding and two-hip roof.

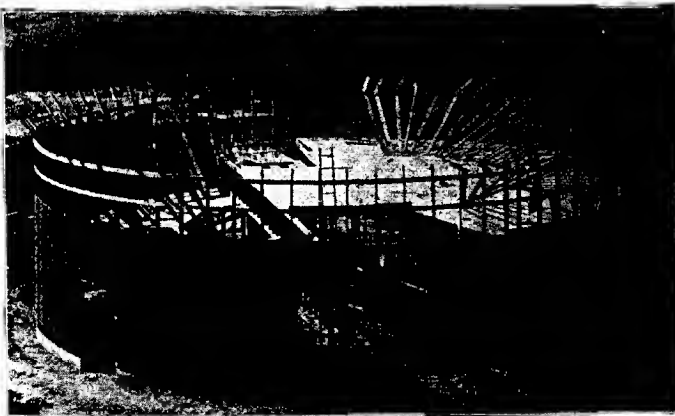


FIG. 32.—BARN NO. 2, UNIVERSITY OF ILLINOIS
First set of rafters lying with the rafter feet on the plate ready to be raised into position.

the rafters. The sheathing is much stiffer and stronger if put on in this way than if put on flatwise. The notches in the rafters facilitate the work of putting on the sheathing and take a large part of the strain off the nails. Care should be taken to break the joints regularly when putting on the sheathing, for if two or more consecutive joints are made on the same rafter this rafter will be raised above the level of the others. The foot of each rafter in the tier should rest on the plate, and should be nailed to a stud, so that the spacing of the first tier of rafters will be governed by the spacing of the studs.

The erecting of the rafters is not difficult when the proper method is employed. There are two methods that may be followed:

In the first method the rafters are raised from the mow floor. The end bearing the rafter foot is placed on the plate beside the stud, the opposite end resting on the floor (Fig. 32). One man mounts the plate, and another man stays on the mow floor. A strip of sufficient length to reach from the rafter foot well down on the stud is fastened with one nail near the outer end of the rafter foot, so that it may be easily removed after the rafter has been secured in place. The man on the floor then raises the rafter, while the man on the plate steadies it. Once in position the rafter pitch is determined by means of a spirit level arranged on the triangular frame, one leg of which has been cut and set at the proper pitch for the rafter (Fig. 33). If the base of the rafter is correctly notched, the proper angle is assumed when the notch fits the plate. The lower end of the strip fastened to the rafter foot is then nailed to the stud to hold the rafter at the



FIG. 33.—BARN NO. 2, UNIVERSITY OF ILLINOIS

Putting the fourth rafter of the second set into place and determining the proper pitch by means of a level.

proper angle (Fig. 34). The rafter is sighted to the center of the barn and stayed securely. The rafter foot is then nailed to the plate and to the projecting end of the stud, thus being securely fastened in position. The other rafters are raised, set, and stayed in the same manner.

As soon as a few rafters are in place, a sheathing strip is nailed in a notch in the rafters about two feet above the plate. Three more sheathing strips are then nailed to each rafter at intervals, and the rafters are kept at the proper distance by keeping them in line with the center of the barn. As the rafters are raised into place, the other sheathing strips, with the exception of one near the top and three near the plate, are nailed. The one just below the second plate is left off so that a man can reach thru to hang the hay track. The strips at the eaves are left off so that the worker can lean thru the opening and nail on the fascia board, and paint it and the rafter feet. As soon as the sheathing is completed, the second circular plate is built and nailed in place. This is made up of 1x4-inch material. One man hands up the boards and two men nail, a fourth man being

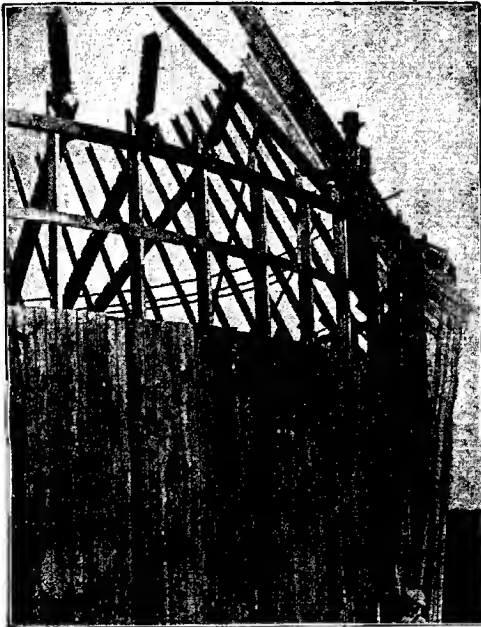


FIG. 34.—BARN NO. 2, UNIVERSITY OF ILLINOIS

Raising the first set of rafters, and holding them in position by means of strips fastened to the ends of the rafter feet.

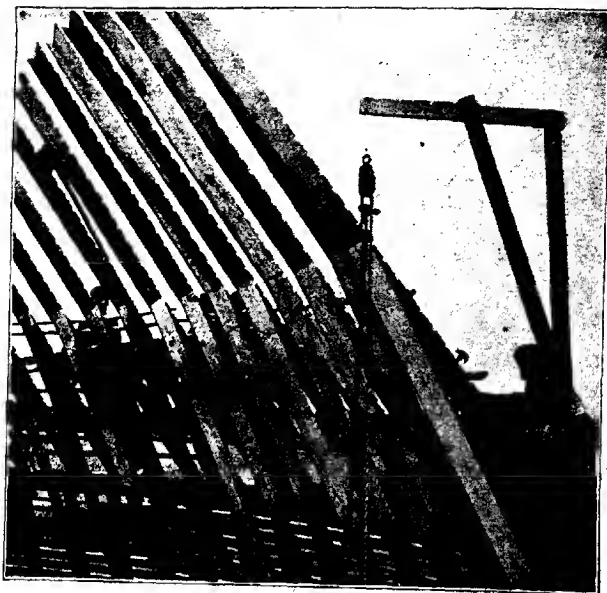


FIG. 35.—BARN No. 3, UNIVERSITY OF ILLINOIS

Pulling up and placing the second set of rafters.

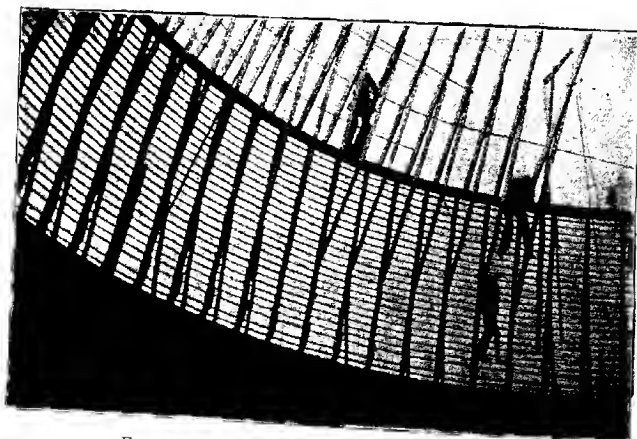


FIG. 36.—BARN No. 3, UNIVERSITY OF ILLINOIS

The first set of rafters in place and the roof strips on. Staying a rafter of the second set in place by means of a brace to the middle of the rafter in the first set.

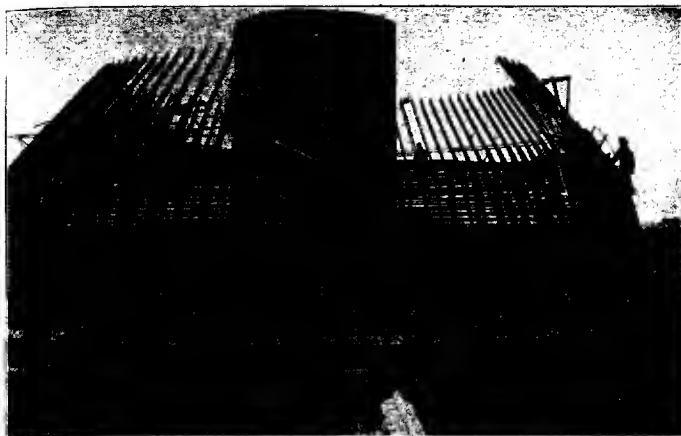


FIG. 37.—BARN NO. 3, UNIVERSITY OF ILLINOIS SHOWING THE SECOND SET OF RAFTERS NEARLY ALL IN PLACE

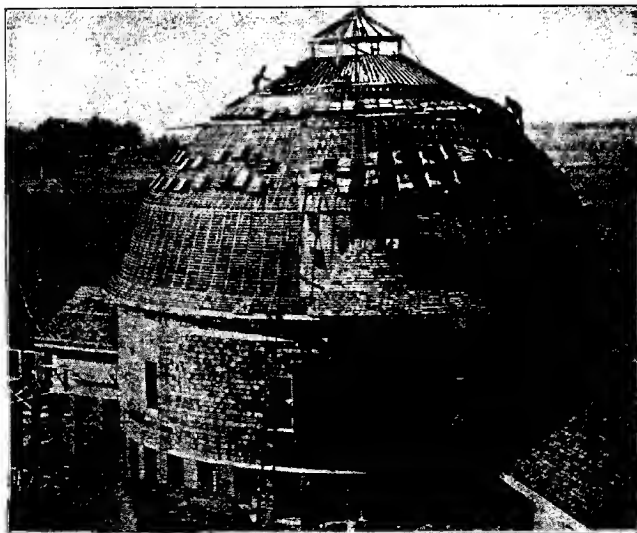


FIG. 38.—BARN NO. 3, UNIVERSITY OF ILLINOIS

Shingles being placed on the lower portion of the roof and the roof strips being put on the third set of rafters.

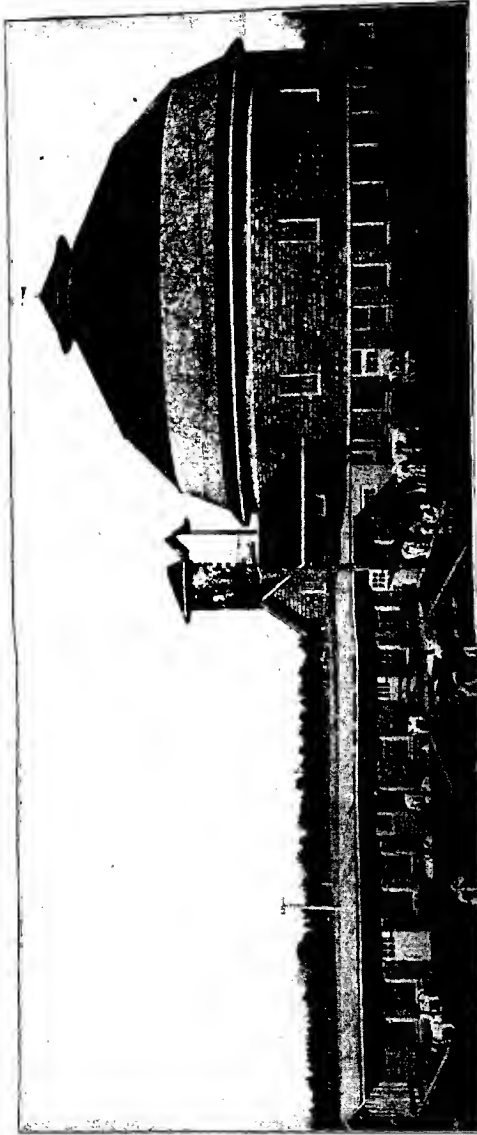


FIG. 39.—BARN No. 3, UNIVERSITY OF ILLINOIS, COMPLETED

This barn is 70 feet in diameter. The first story is built of brick, the superstructure covered with shingles, and the roof of the two-hip type.

employed to help bend the members into place. When well sprung into position, the first board should be nailed against the rafter ends, and as the other members of the plate are put in place they should be thoroly nailed between the rafters, care being taken not to split the members.

To facilitate the raising of the first rafters of the second and third sets, a temporary lever is fastened to the top of the first, third, fifth, and seventh rafters as shown in Fig. 33, and stayed by temporarily nailing a strip from the outer end of the lever down to a rafter in the set below. A few sheathing strips are put on as soon as these four rafters are in place, after which the second, fourth, and sixth rafters are raised into place and fastened to the sheathing strips. The succeeding rafters are drawn up, put into place, and held by the sheathing strips, to which they are made fast at once. After ten or a dozen rafters are up and the sheathing securely nailed on, as high as can be conveniently reached from the plate, they will be rigid enough to support the weight of a workman; and some of the other sheathing strips should be nailed into place and carried around as the rafters are erected.

A second and even more successful method of raising the rafters into place is that illustrated in Figs. 35 and 37, the light derriek with the rope and pulley taking the place of the temporary lever and stay strip. This method works satisfactorily for all sections of the roof. Instead of nailing the temporary stay strip, as in the other method, a brace is nailed to the rafter five or six feet from the lower end, and when the rafter is placed in position it is firmly nailed and the lower



FIG. 40.—VIEW OF SEVENTY-FOOT SELF-SUPPORTING ROOF

Note hoops on studs in right foreground.

end made fast to a rafter in the set below or to a stud in the case of the first set.

In placing the last set of rafters in a two-hipped roof, difficulty may be experienced because of the small diameter of the circle to which the sheathing boards must be bent. The flatness of this portion of the roof also makes it difficult to make the rafters self-supporting. To overcome this, scantling can be placed across the circular plate built up on the top of the second set of rafters in such a way as to form a scaffold, and boards can be laid on these from which the carpenters may work. The sheathing boards near the top can be put on most readily after the first member of the plate has been built into the top of the last set of rafters. Great care must be taken to keep these built roof-plates level. Unless this is done, the roof may be unsymmetrical. The rafters should be properly pitched when set in place, and as the first member of the plate is put in place it should be sprung and the strip adjusted in the notch of the rafter until the proper level has been obtained.

In the fourth type of roof, shown on the barn in Fig. 46, the rafters are built up in a form on the ground out of 1x4-inch material like the purline plates in the roof described above. With this type of rafter, a perfect dome can be made without a break in the roof.

The work of framing studs and rafters for a barn with vertical siding and self-supporting roof in which small sheathing strips are used is considerably more than for one in which horizontal siding and sheathing boards are used. But this work is more than balanced when it comes to erecting the frame, as the place for every hoop and every roof board is marked by a notch. The chief care in erecting the barn is the plumbing of the studs and the spacing and erecting of the rafters. The pitch of the roof will not cause any concern because a properly framed rafter, if placed to fit the plate, must assume the right pitch if the plate is level.

CUPOLA CONSTRUCTION

It is both economical and convenient to provide ventilation in the round barn thru a centrally located ventilating flue. In a barn with a silo, the silage and hay chutes may be used for this purpose.

The cupola should be constructed so that it may be utilized as a ventilator, thus saving the expense of eowls. For a 60-foot round barn, eight openings in the cupola seem to give a satisfactory finish. Four of these may be closed with a sash having four 8x10-inch lights. The other openings should be of the same size, slatted, and covered with a small-meshed woven wire to keep out birds. The design of the cupola should be such as to give a finished appearance to the structure. To do this, it should not be so small that it looks like a chimney nor so large and flat that it resembles a hood.

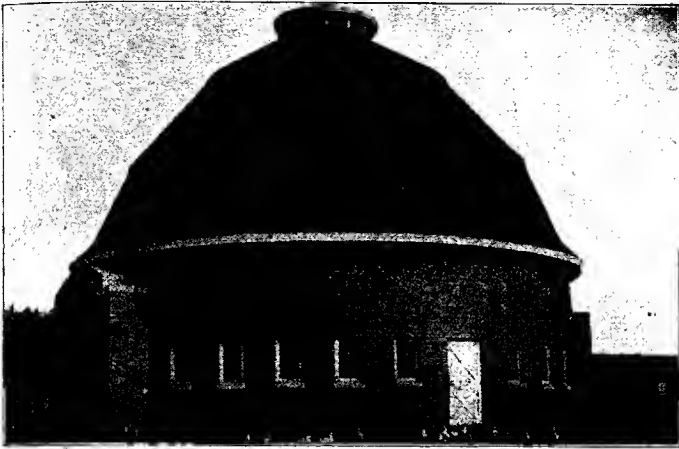


FIG. 41.—A SUBSTANTIAL, WELL-PROPORTIONED ROUND BARN, WITH THE FIRST STORY BUILT OF BRICK

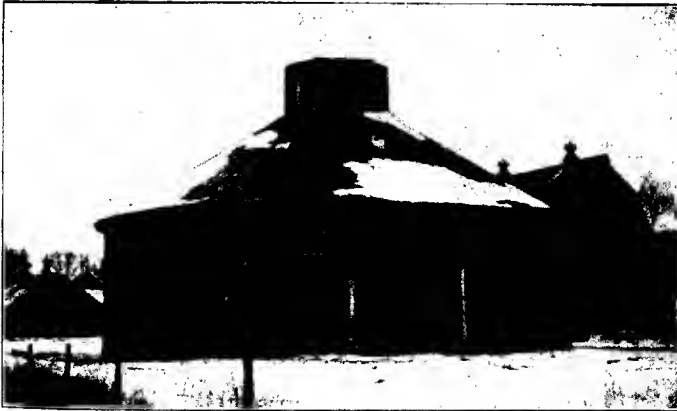


FIG. 42.—A ROUND BARN EIGHTY FEET IN DIAMETER BUILT OF HOLLOW VITRIFIED TILE

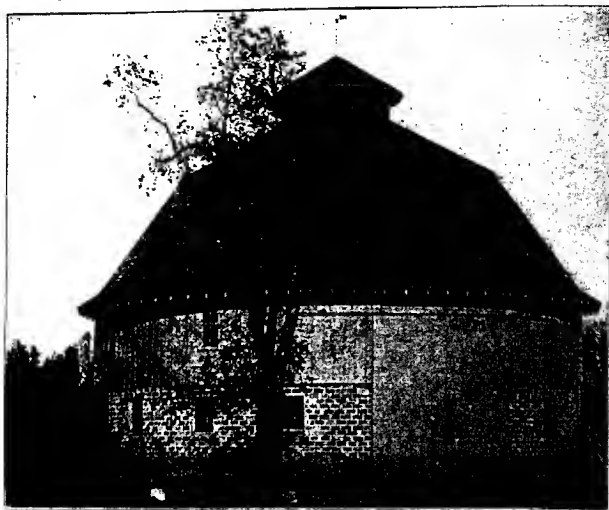


FIG. 43.—A WELL-PROPORTIONED DAIRY BARN SIXTY FEET IN DIAMETER
The first story is built of vitrified tile blocks.

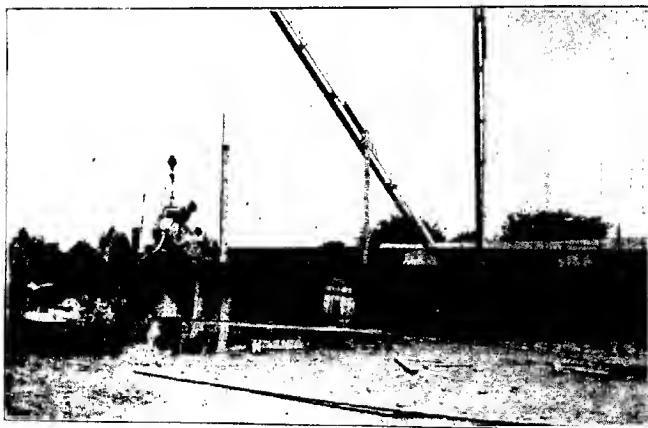


FIG. 44.—POURING CONCRETE INTO FORMS FOR THE FIRST SECTION OF A
MONOLITHIC CONCRETE ROUND BARN

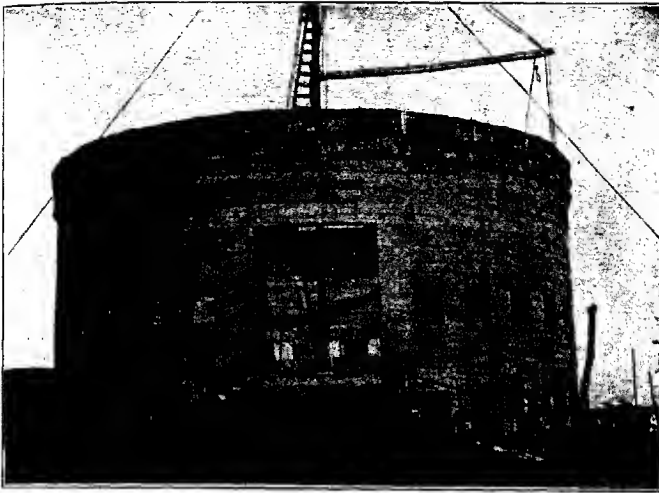


FIG. 45.—A ROUND DAIRY BARN SIXTY FEET IN DIAMETER; MONOLITHIC CONCRETE CONSTRUCTION

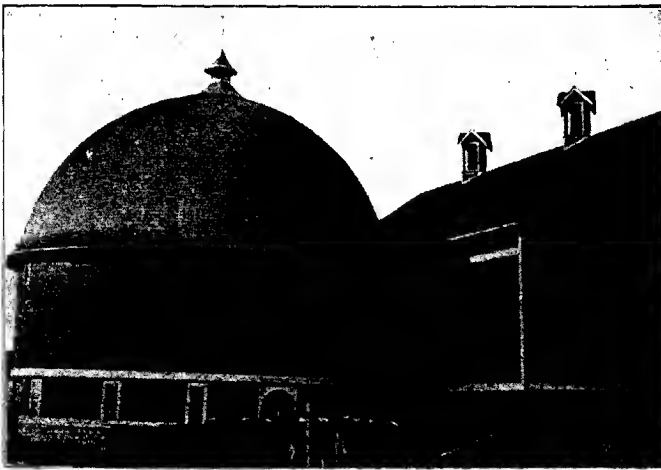


FIG. 46.—A ROUND DAIRY BARN AS AN ANNEX TO A RECTANGULAR BARN

The round barn is 54 feet in diameter, 24 feet high at the eaves, and 50 feet at the center. It has a silo in the center and a driveway to the second floor. One of the interesting features of this barn is the dome-shaped roof.

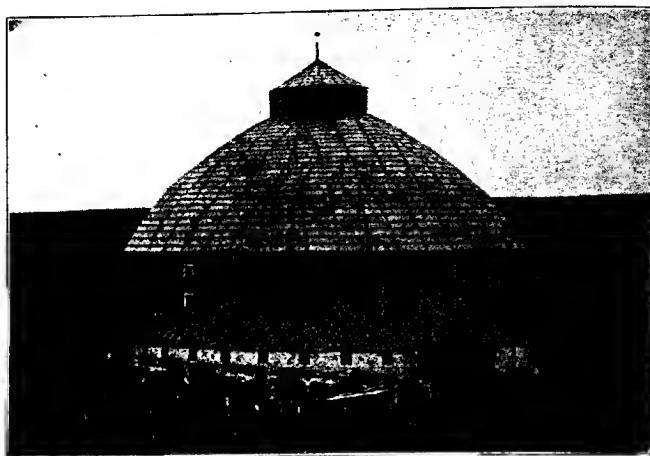


FIG. 47.—ROUND, GENERAL-PURPOSE BARN

This barn is 100 feet in diameter and 40 feet high at the eaves. There is a driveway to the second floor, but no silo. Capacity: 200 cattle, 600 tons of hay, 5,000 bushels of grain, and farm machinery.



FIG. 48.—FEED ALLEY, SHOWING COMBINED HAY CHUTE AND VENTILATOR

A door on the side, which is hinged at the bottom 3 feet from the floor, is let in toward the silo, sliding the hay out on to the floor. In hot weather this opening takes the heat from the top of the stable. During the winter this door is kept closed and the ventilation is regulated by raising the slide, as shown in the cut.



FIG. 49.—A WELL PROPORTIONED BARN SIXTY FEET IN DIAMETER

The first story is brick. A hood over the door furnishes protection in bad weather.

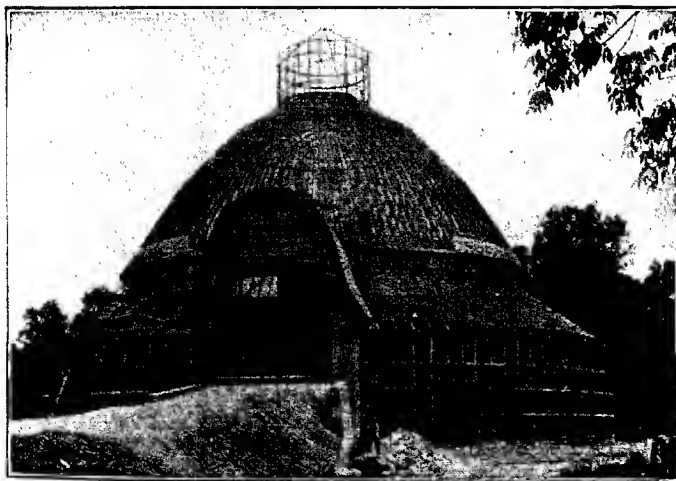


FIG. 50.—CONSTRUCTION OF BARN IN FIG. 51

The hoops are in place ready for the perpendicular siding. The roof is sheathed for shingles.

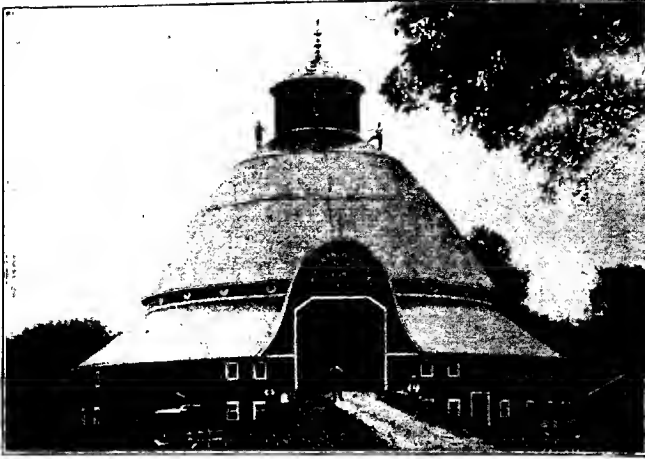


FIG. 51.—A BARN 102 FEET IN DIAMETER AND 85 FEET HIGH

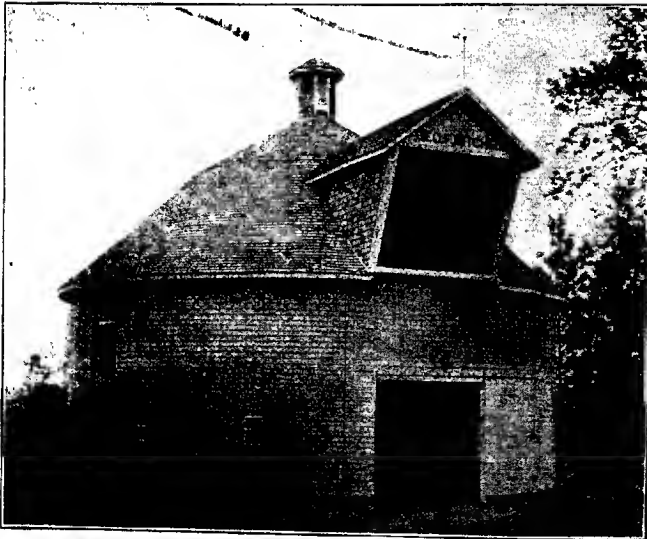


FIG. 52.—A BARN 48 FEET IN DIAMETER, WITH 16-FOOT POSTS
Note method of taking in the hay.

DOOR CONSTRUCTION

Small doors for round barns may be made by nailing two layers of flooring diagonally across one another in such a manner that they will conform to the curve of the wall. The inner layer of boarding should be vertical, and should be nailed to temporary cleats bent to the desired curvature. While thus firmly held in place, the diagonal boards for the outer portion should be well nailed down with nails of sufficient length to make a good clinch on the inside. Pine boards can well be used for the inner layer, and cypress for the outer layer and the strips that bind the edges of the doors.

For the large openings, doors which will slide readily are made like those described above, or in flat sections from two to three feet wide, and hinged or joined with iron straps in such a manner as to make them conform to the curve of the barn wall. If these are made to slide inside of the wall, the wind cannot blow them so easily from the hangers. Circular doors should be substantially made and hung with swivel hangers on a strong track, as the doors have a tendency to bind on a circular track unless it is very rigid.

Swinging doors may be satisfactorily used in a rectangular projection. Such doors will not, however, work satisfactorily if they are to close openings at the top of an inclined approach.

Sliding doors that slide back into a rectangular projection on the barn, such as are shown in Figs. 17 and 31, are satisfactory, but such an arrangement is slightly more expensive than one in which doors are built to conform to the circle of the barn.

HAY OUTFITS FOR ROUND BARNES

There are several kinds of equipment that may be used for unloading hay in round barns. The most common is the circular track upon which a swivel truck carrier is used. The installation of such a track requires the use of numerous guide rollers to keep the carrier rope in line, and unless these rollers are installed at the proper angle, difficulty may be experienced in moving a heavy load around the track. The circular track is practically the only one that can be used in a barn having a silo in the center, if the hay is to be mowed about the entire loft, as this outfit makes possible the placing of the hay behind the silo. If feed bins and other storage occupy the space directly opposite the point at which the hay is taken in, a divided, or V-shaped, curved track may be installed. In barns having no silo in the center, a three-way V, straight track may be used.

In one of the round barns at the University of Illinois a combination of the straight and curved tracks is giving satisfaction. The curved track is installed in such a way that the track directly above

the place at which the hay is unloaded comes considerably lower than that portion of the track further back in the barn. The track is at its highest point at about the center of the barn, where a slight curve is made, and from here it takes a diagonally downward direction toward the opposite side of the barn, allowing the loaded hay carrier to travel the desired distance from this point by force of gravity.

In small barns in which no drive has been provided to the second floor, the hay may be taken up thru an opening in the mow floor directly above the drive (Fig. 17), or thru a special opening in the roof as shown in Fig. 52.

SUMMARY

It is not the intention of this circular to give preference to the round type of building, but simply to show the right method of round barn construction for those who build this type as best fitting their own needs. No one type has yet been evolved which meets every requirement perfectly, so it rests with the farmer to choose that one which best fills his wants.

To sum it up briefly, the round barn means economy of building expenditure, increased mow capacity, greater convenience, and the attendant lessening of barn labor.

